Prodigy Cuber Technical Training

Revised 2009

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Introduction

- Overview
- Installation
- Operation
- Diagnosis
- Service

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Prodigy Overview

- Modular cubers
  - Air cooled, water cooled, remote air cooled
    - Remote low side in separate presentation
- 22”, 30” and 48” wide platforms
  - 22 and 30 inch platforms have one evaporator
  - 48 inch platforms have two evaporators
- Common look and operation across models
- Front service access to most components

Model Number Scheme

- C0330SA-1A
  - C = cuber
  - 03 = 300 lb category
  - 30 = cabinet width in inches
  - S = small or half dice cube
  - A = air cooled
  - -1 = voltage code
  - A = series

Ice Form

- Either half or full dice cubes
  - Small – half dice
  - Medium – full dice

C0322 and C0522

- 22” wide models
  - 23” tall
- Evaporator on right
  - C0322 has 6” high evaporator
    - Air and water cooled models
  - C0522 has 12” high evaporator
    - Air, water, and remote models

C0330, C0530, C0630, C0830 and C1030

- 30” wide models
- Evaporator on right
  - C0330 has 6” high evaporator
    - 23” tall cabinet
  - C0530, C0630 have 12” high evaporators
    - 23” tall cabinet
  - C0830 and C1030 have 18” high evaporators
    - 29” tall cabinet

C1448, C1848, C2148

- 48” wide models
- Two 18” high evaporators face each other
- Similar operation to smaller models
  - Same control system & options
  - Same curtains
  - Same sensors
  - Same water distributors

Prodigy Installation – All Models

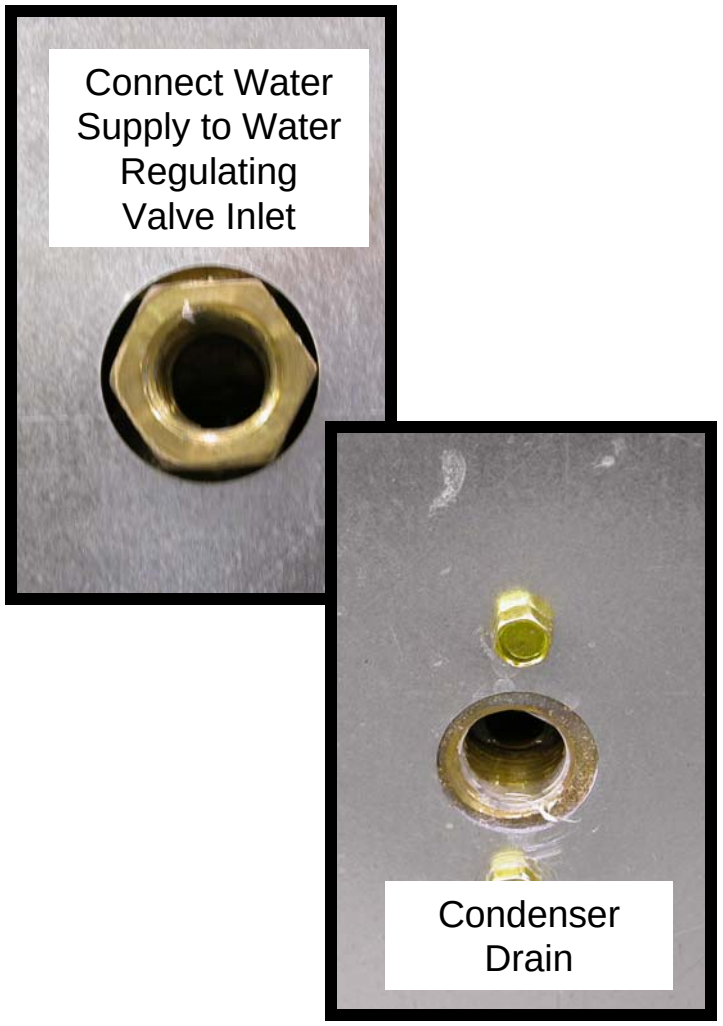
- Set the machine in place
- Remove any packing
- Level the cabinet
- Connect drain (s)
- Connect water supply
- Remotes: Route and connect tubing to condenser
- Add any optional accessories
  - Smart Board, Vari Smart, Air Baffle, Front Air In
- Connect power

Prodigy Installation – Air Cooled

- Potable water connects to 3/8 fitting on back of cabinet
  - Fitting is 3/8” female pipe thread – direct connection to inlet water solenoid valve
    - Adapter to 3/8” male flare packed in unit
- Reservoir drain fitting is ¾” female pipe thread
  - Vent for proper draining
  - Minimum slope of ¼” fall per foot of horizontal run

Prodigy Installation – Water Cooled

- Same as air cooled plus an inlet and drain for the water cooled condenser
  - Water cooled inlet should not be filtered
  - Water cooled drain tube should not be vented

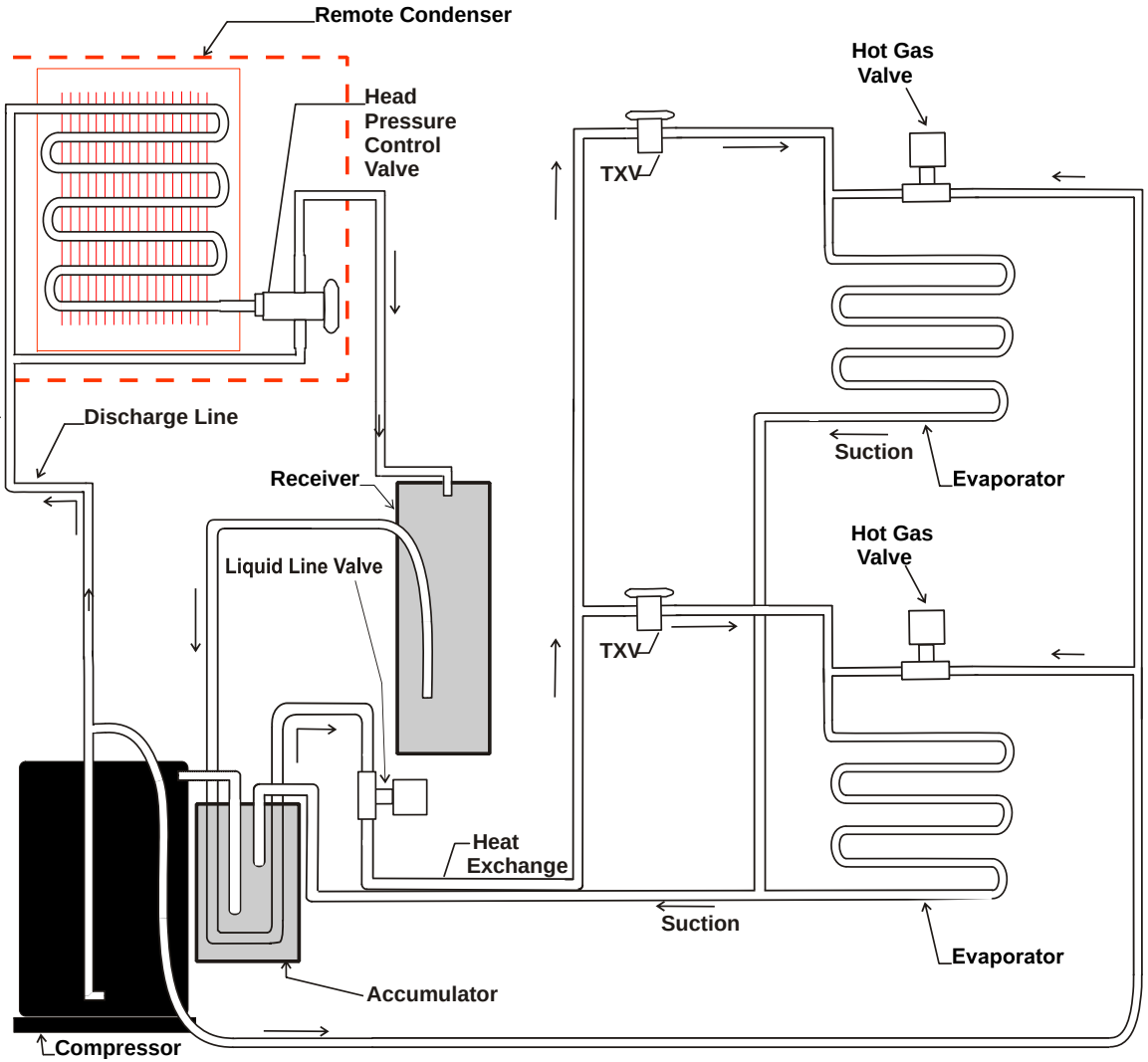


Prodigy Installation – Remote Air Cooled

- MUST use condensers with headmaster in them:
  - ERC111, 211, 311 and 611
  - RTE line sets – 10, 20, 40, or 75 foot lengths
    - 3/8 liquid
    - 1/2 discharge
  - Power supplied by ice machine for fan motor
  - Same limitations as other current models

Remote System Configuration

C1448R,
C1848R,
C2148R
Refrigeration
Circuit



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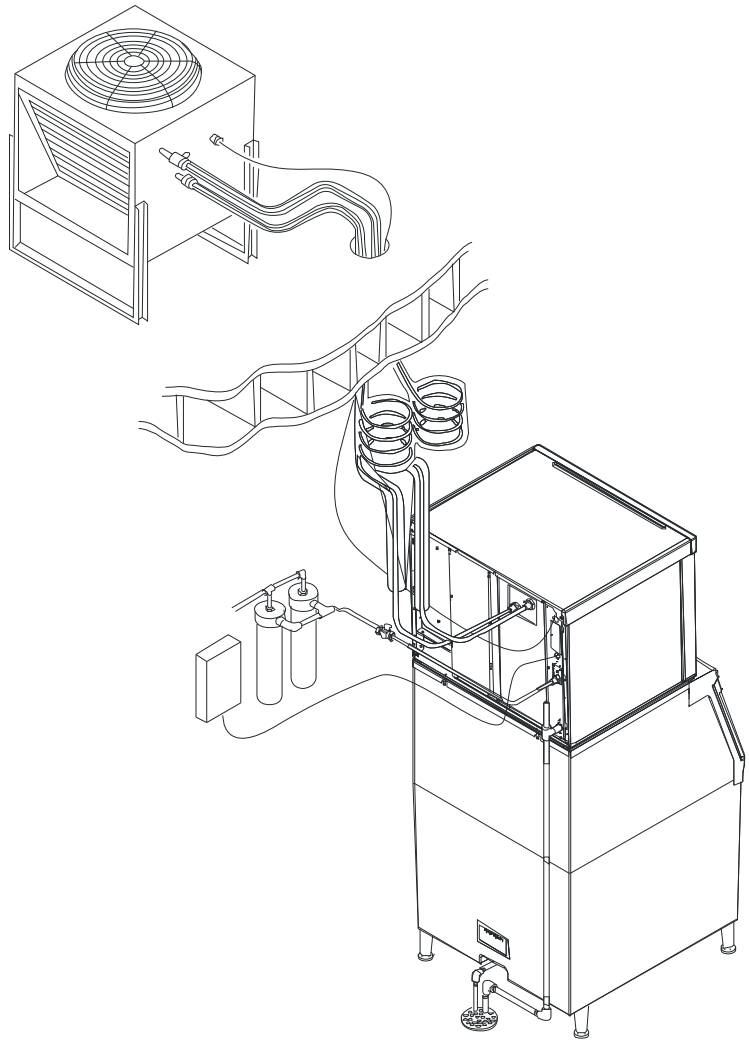
Remote Installation

- Same limitations and requirements as other Scotsman remote models
- Select the location for the ice machine and condenser
  - Minimize line set length for ease of installation
  - Follow Scotsman's guidelines for location

Remote Installation

- Typical Installation
  - Condenser above ice machine
  - Precharged line set coiled within building
    - Use horizontal coil
    - NEVER leave excess coiled up on the roof!



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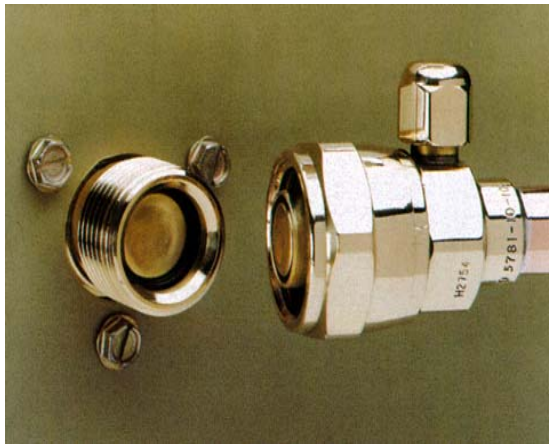
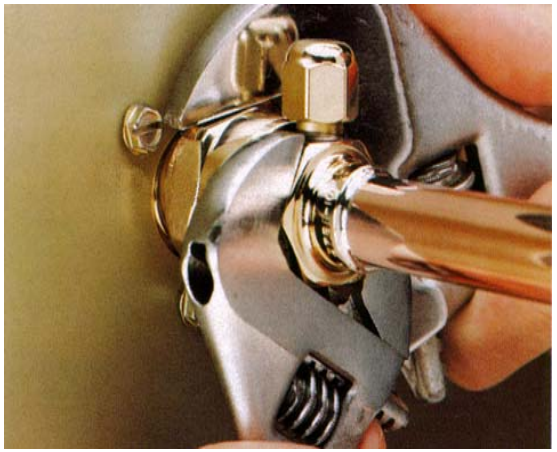
Remote Installation



Clean and **Lubricate** Quick Connect Couplings



Use Two Wrenches to Tighten

Rotate Swivel Nut **One Quarter Turn** More After Nut Becomes Tight

Incomplete Assembly: One Thread Showing

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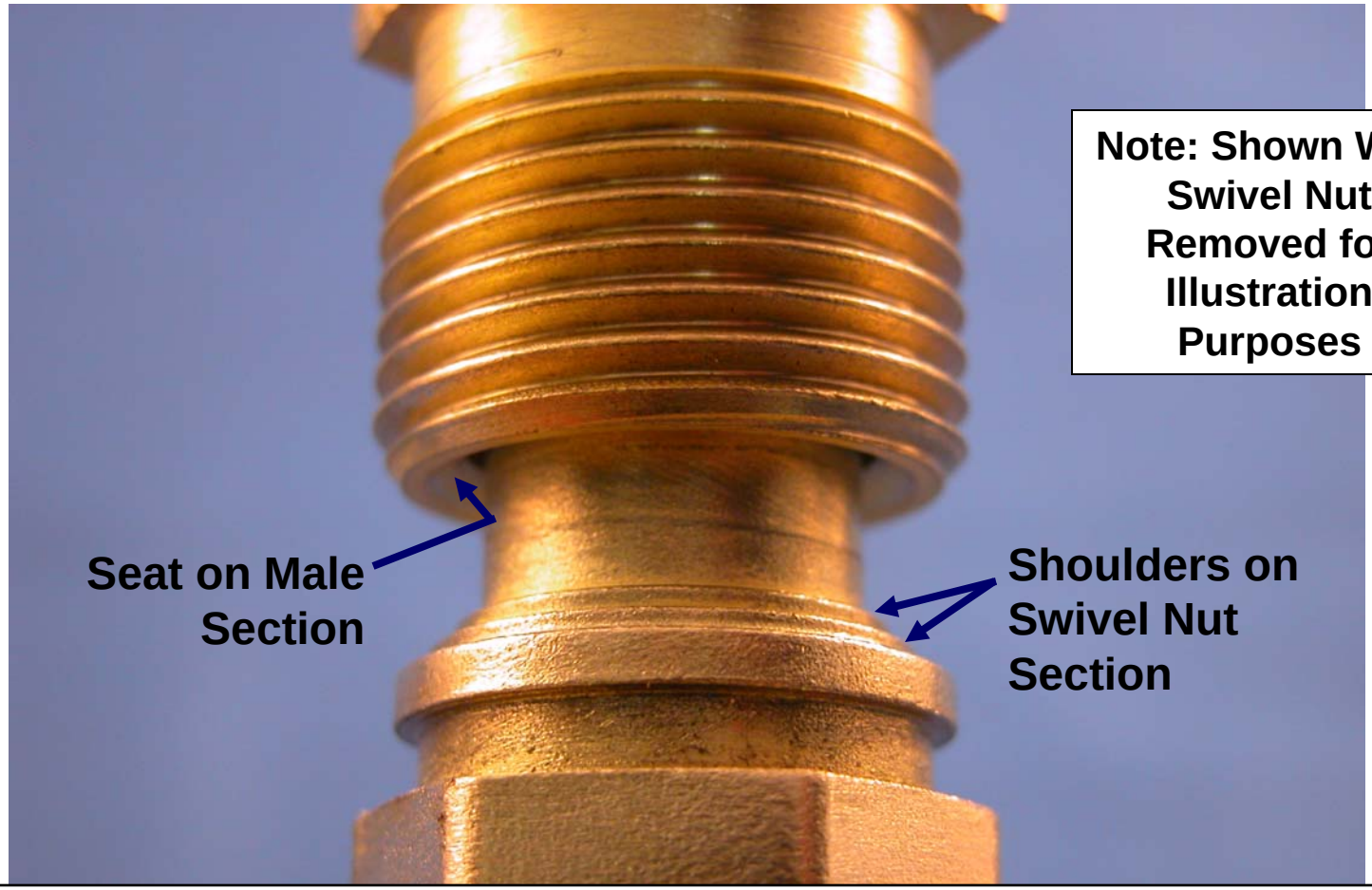
Quick Connect Joint



At final ¼ turn, the shoulders of the swivel nut section are forced into the seat area of the male section, forming the grooves that make the seal

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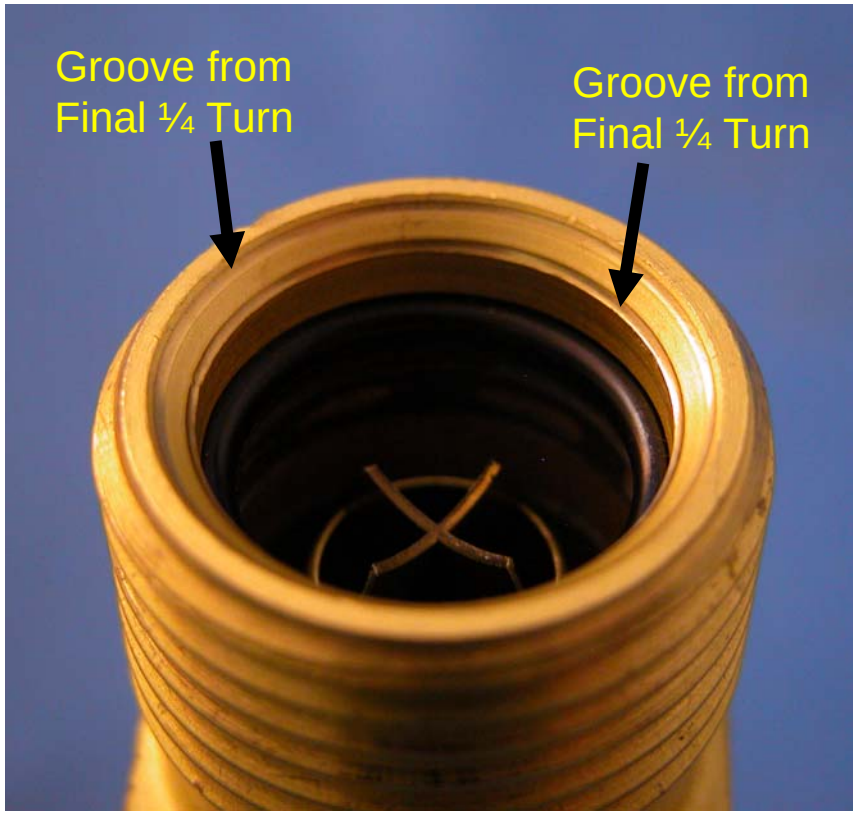
Coupling Sealing

Before



After

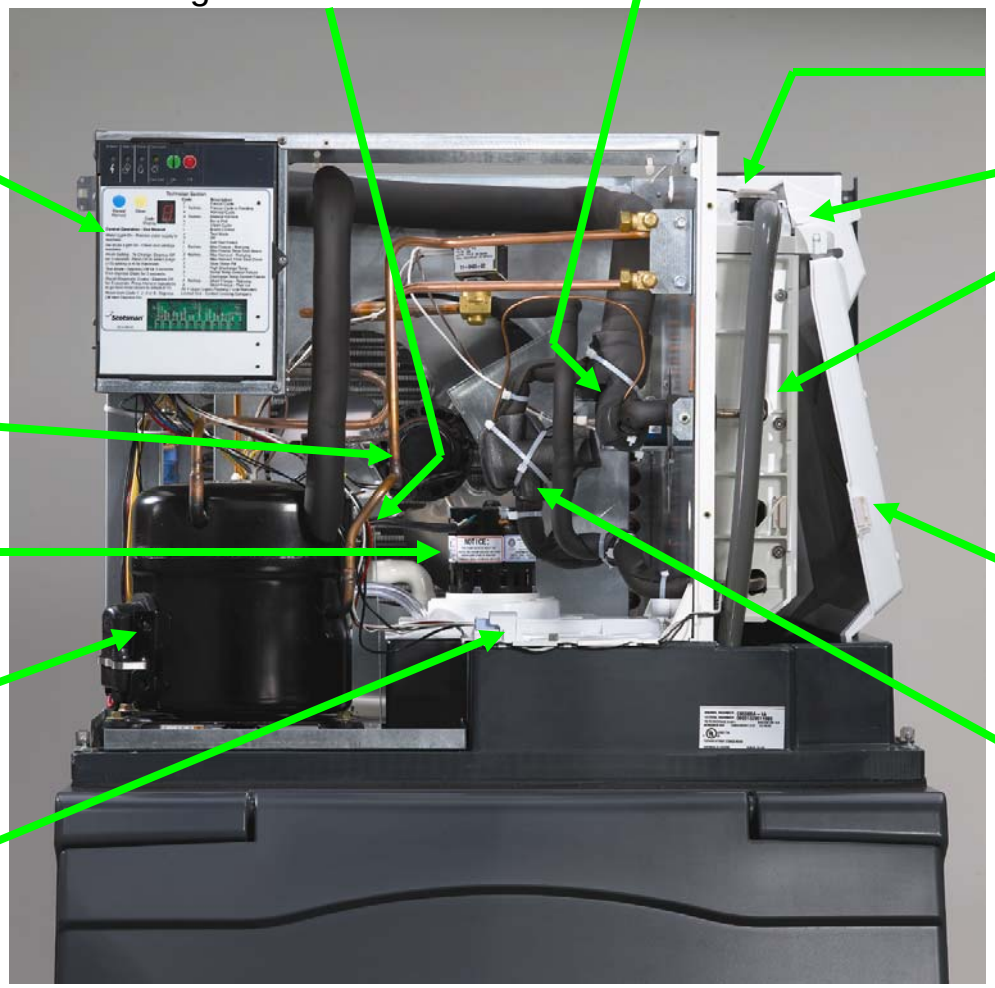
Components

- Refrigeration:
  - Compressor, condenser, thermostatic expansion valve, hot gas valve, evaporator, and R-404A
    - One hot gas valve and one TXV per evaporator
  - Remotes also have a liquid line valve
- Water:
  - Water pump, inlet water solenoid valve, purge valve, water distributor

Components

- Electrical
  - PTCR for compressor starting
  - Harvest assist solenoid
  - Fan motor – air cooled and remote air cooled
  - Fan cycling pressure switch for self contained air cooled
- Control System
  - 12 volt transformer
  - Electronic controller
    - Operates all loads
- Sensors
  - Water level sensor
  - Ice thickness sensor
  - Curtain switch
  - Fan pressure switch;
  - Water temperature sensor
  - Discharge temperature sensor
  - High pressure cut out on some models

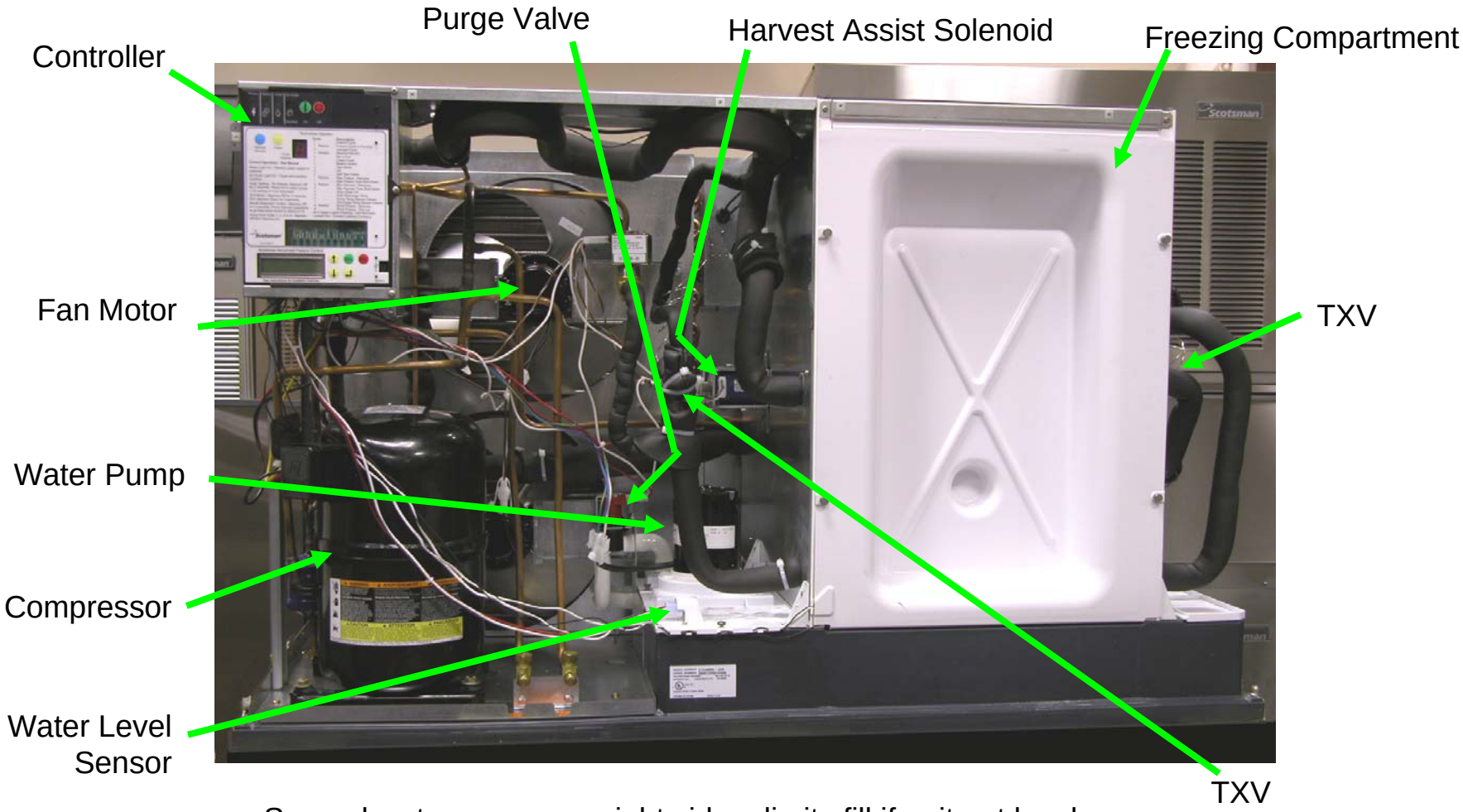
Component Location – 30” wide models



Air Flow and Control

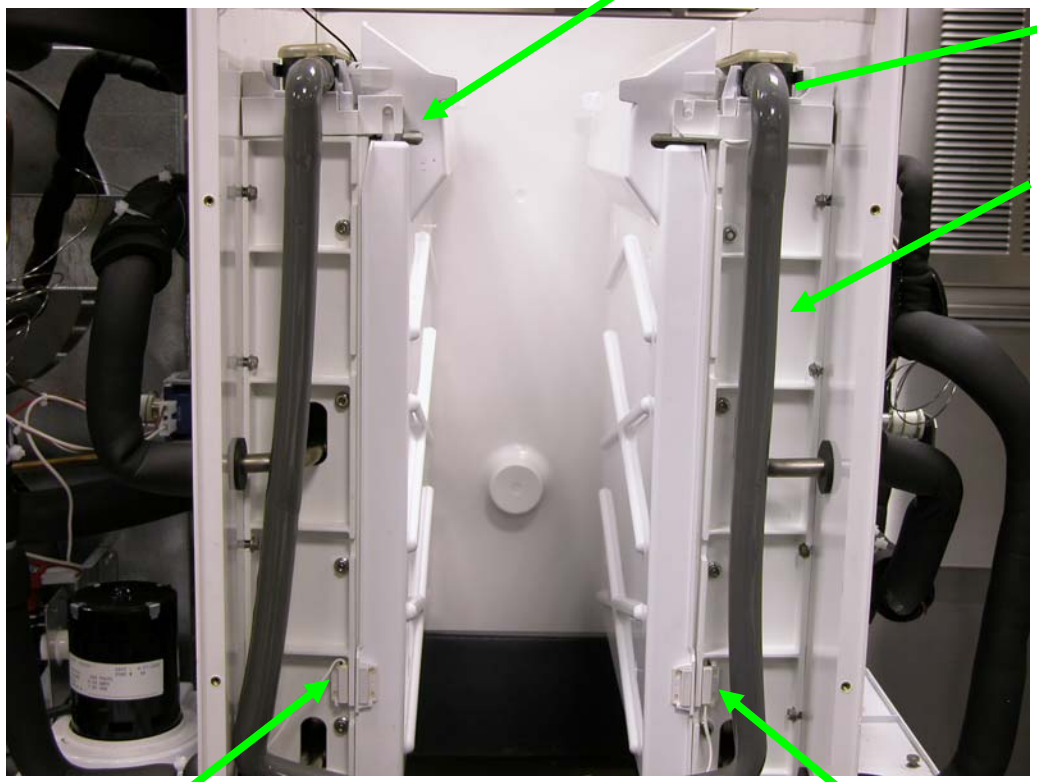
- Air flow is in the left and out the back
  - Front air in optional with panel kit
  - Baffle is also optional
  - Left white panel no longer used

Component Location – 48” wide models

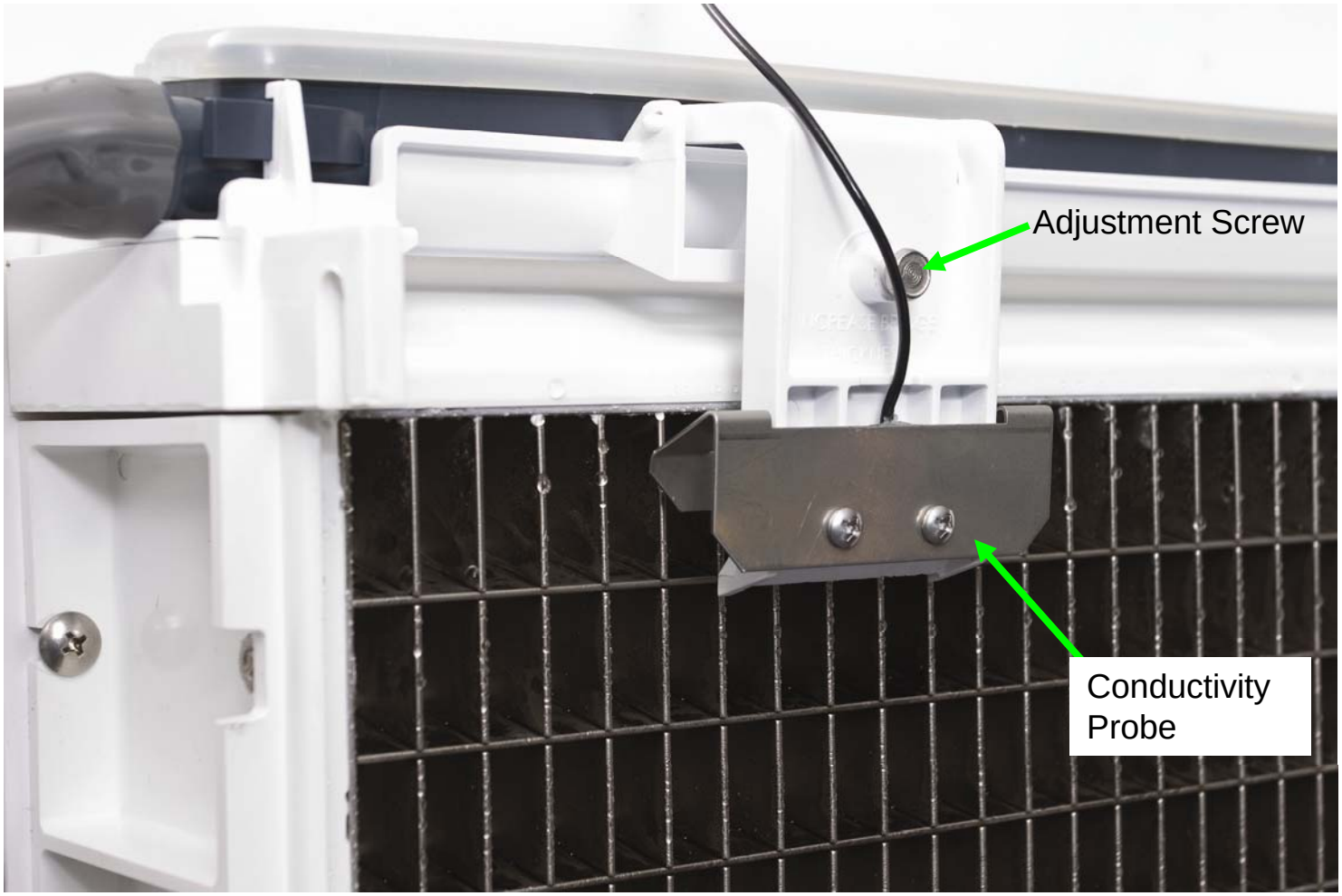


Second water sensor on right side – limits fill if unit not level.

48” Models – Freezing Compartment



Ice Thickness Sensor – All Models



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Prodigy Operation

- Electrical Sequence
  - Power up, controller does self check
  - Power Light glows Green
  - Push and release the green ON button to start the unit

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Start Up – Air and Water Cooled

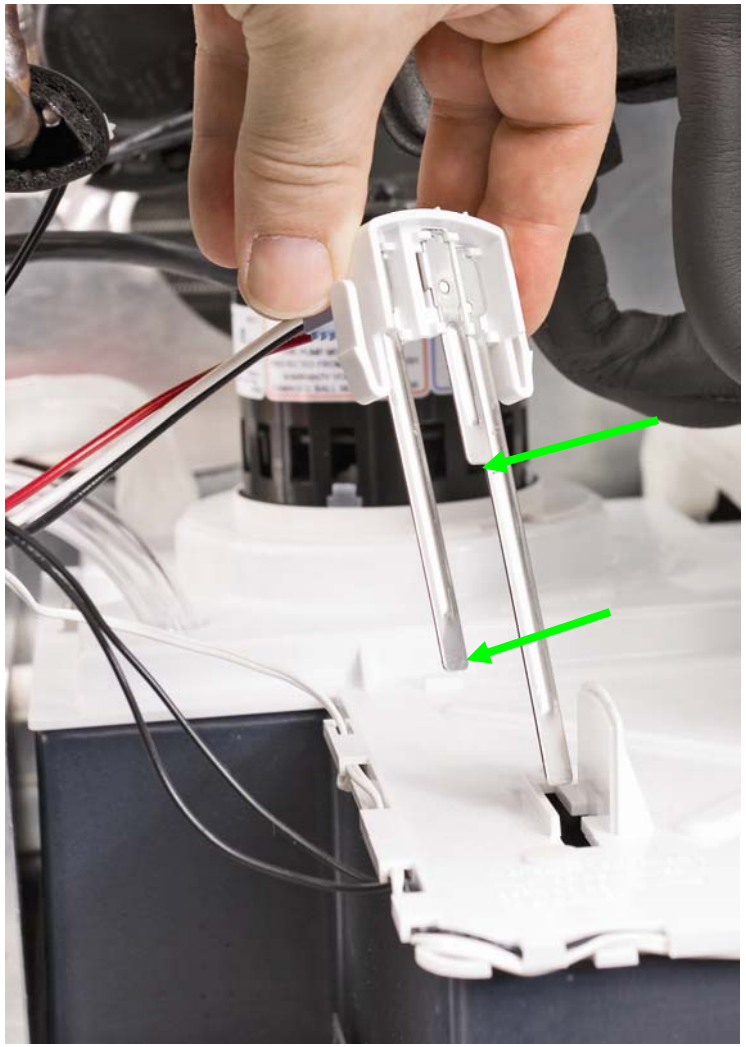
- Reservoir emptied and refilled
  - Purge valve opens, water pump starts
  - Hot gas and harvest assist solenoid activate
  - Inlet water valve opens, water fills the reservoir
  - Purge valve closes, pump shuts off
- When the reservoir is full, the water stops and the compressor and pump start
  - Fan motor will start when discharge pressure increases to cut in point of fan cycle switch

Start Up - Remote

- 4 hour compressor soak out before operation
- Open receiver outlet valve
- Push and release ON switch
  - Purge valve opens, water pump starts
  - Hot gas and harvest assist solenoid activate
  - Inlet water valve opens, water fills the reservoir
  - Purge valve closes, pump shuts off
  - When the reservoir is full, the water stops, the liquid line valve opens and the compressor and pump start

Water Control – All Models

- Water Level Sensor
  - Conductivity Probe
  - Water fills when mid-length probe is not touching water
  - Water stops filling when short probe touches water
    - Snaps out of reservoir cover for ease of maintenance

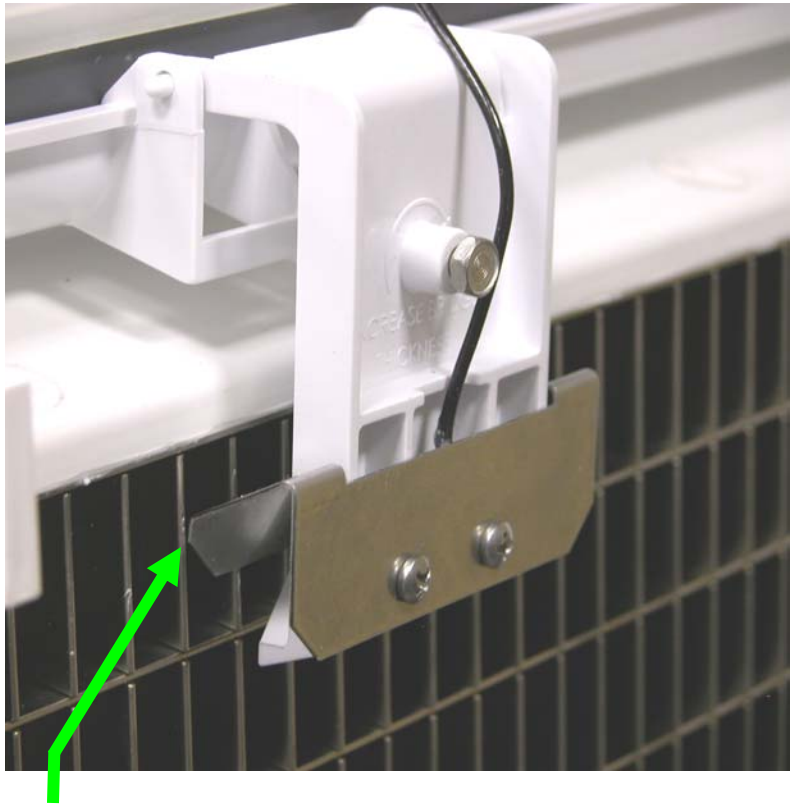


Freeze Cycle

- Hot gas valve closes and harvest assist solenoid pin retracts after 5 seconds of freeze.
  - Allows compressor to start with minimal discharge pressure
- Freeze continues until reservoir temp falls to preset point, then pump stops for 30 seconds.
  - The dry freeze is an anti-slush process

End of Freeze Cycle

- Freeze continues until ice thickness sensor is contacted by water for a few seconds, that triggers harvest
- Air cooled fan may shut down a few seconds before harvest to build up heat

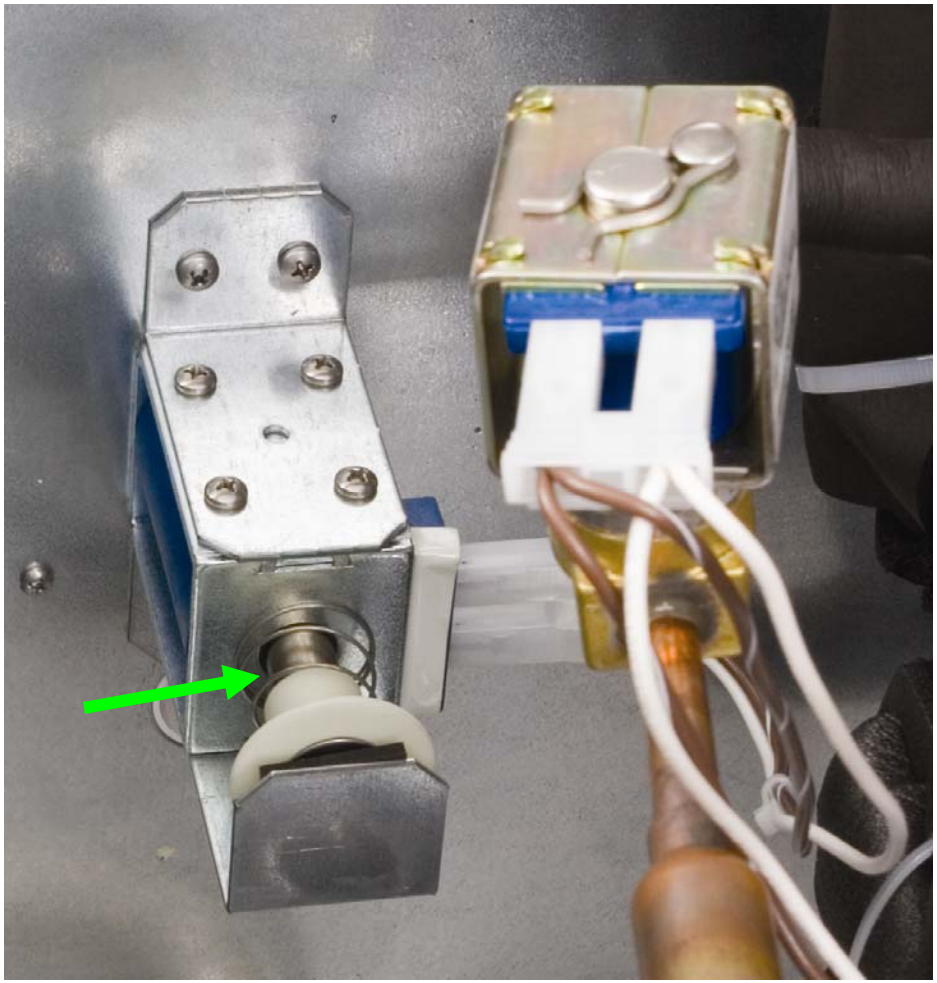


Ice Thickness Sensor

Contact with water makes circuit from controller to cabinet, terminating freeze

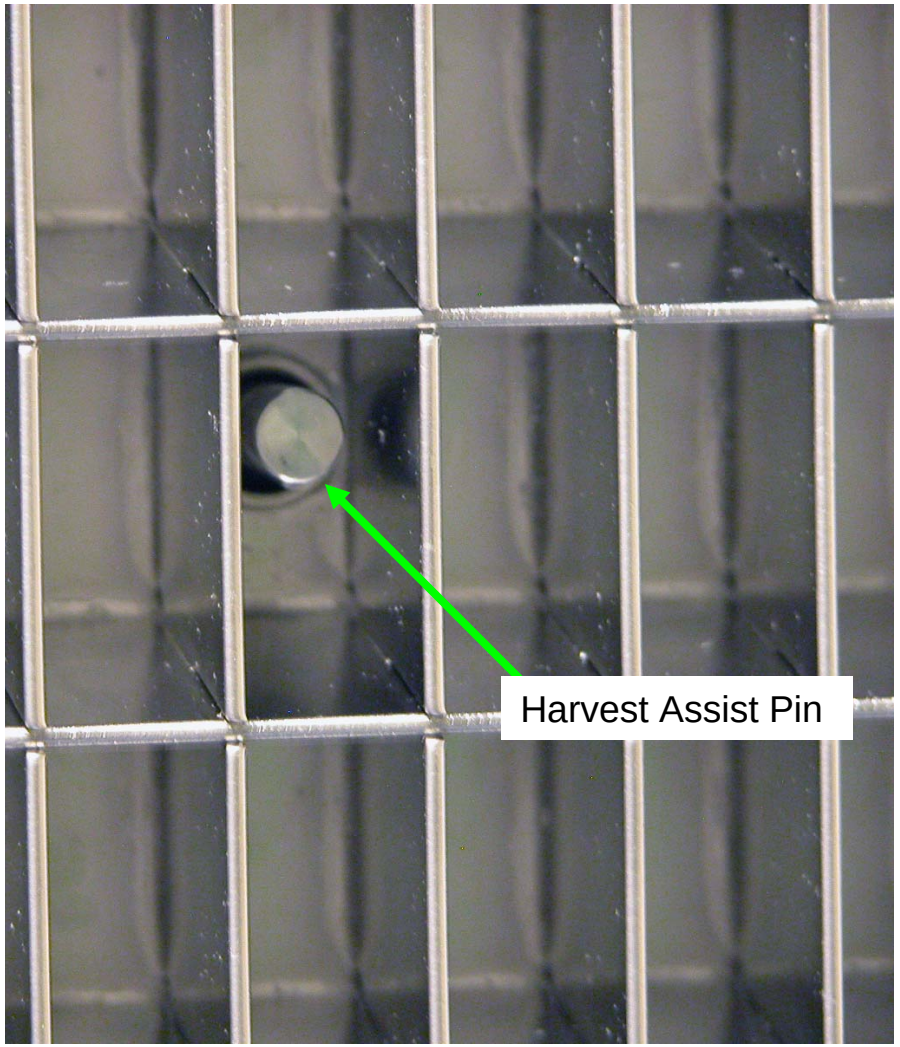
Harvest Cycle

- Air cooled fan motor shuts off
- Harvest assist and hot gas valve solenoids are energized
  - Harvest assist pin will push but not move until ice releases
- Water purges



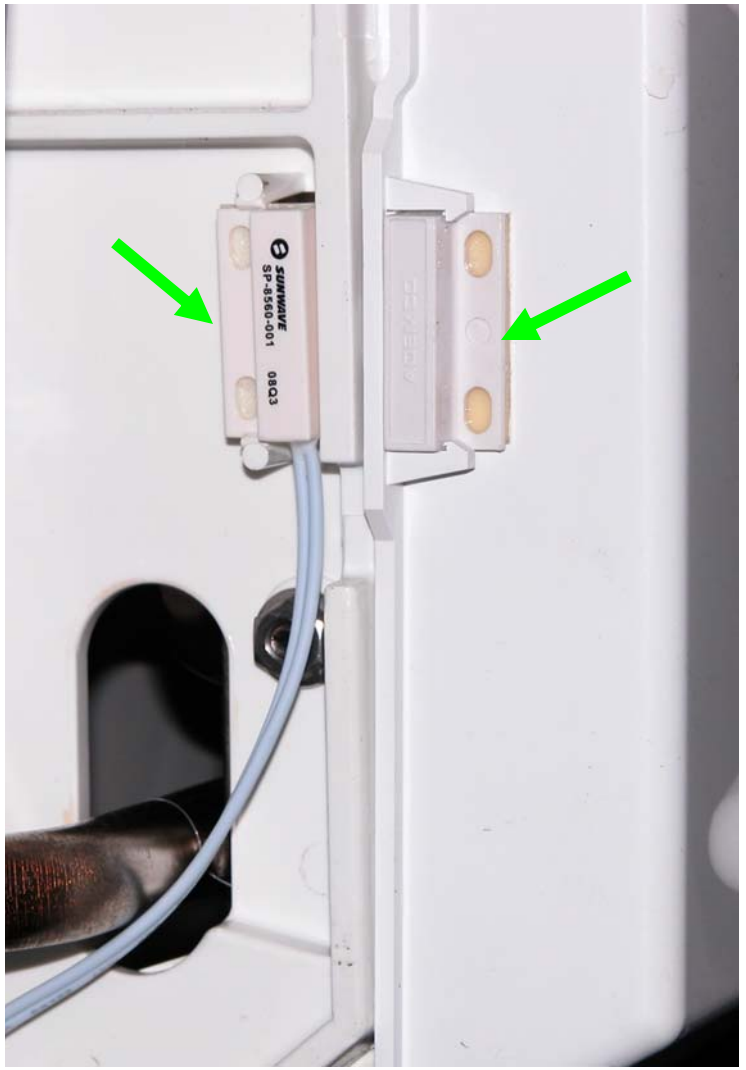
Harvest Assist Solenoid

- Harvest continues until the evaporator heats up enough to release the ice, the harvest assist solenoid pin will extend fully and the ice will release as a unit, forcing the curtain open
- Design change to separate pin mid 2009



Curtain Switch

- The curtain switch opening terminates harvest.
  - Stays open = shuts off. If it closes again, a new freeze cycle begins.
  - Switch is the magnetic reed type
  - Supplier and wire routing change in mid 2008



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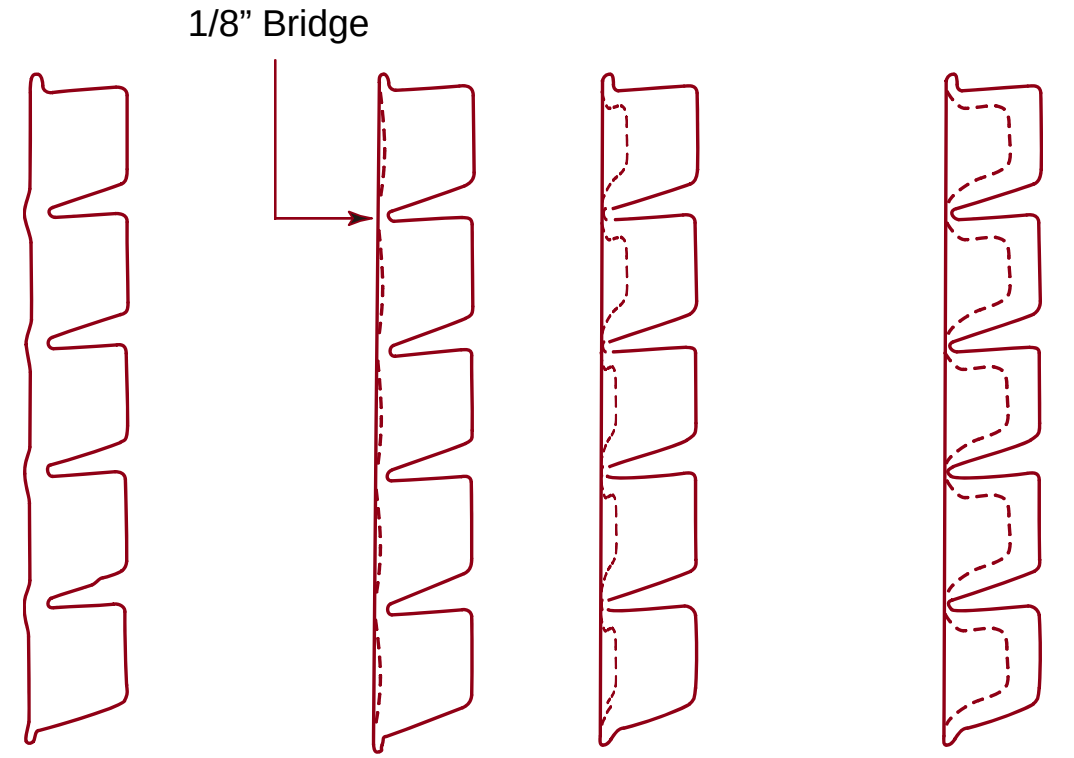
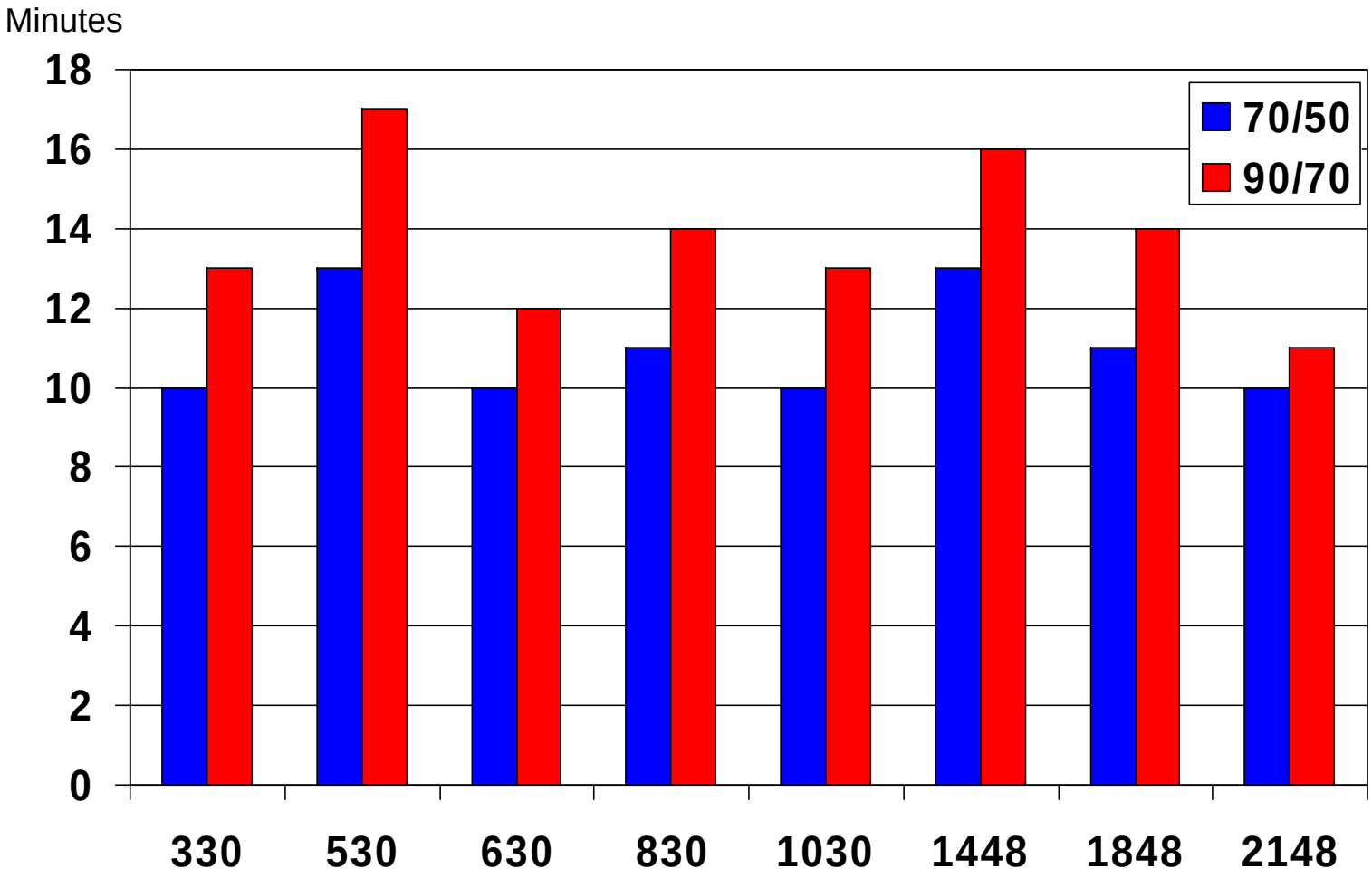
Ice Bridge


1/8” Bridge
Too Big
Just Right, most models
Just Right, Medium cube, C0322 and C0330
Too Small

Total Cycle Times



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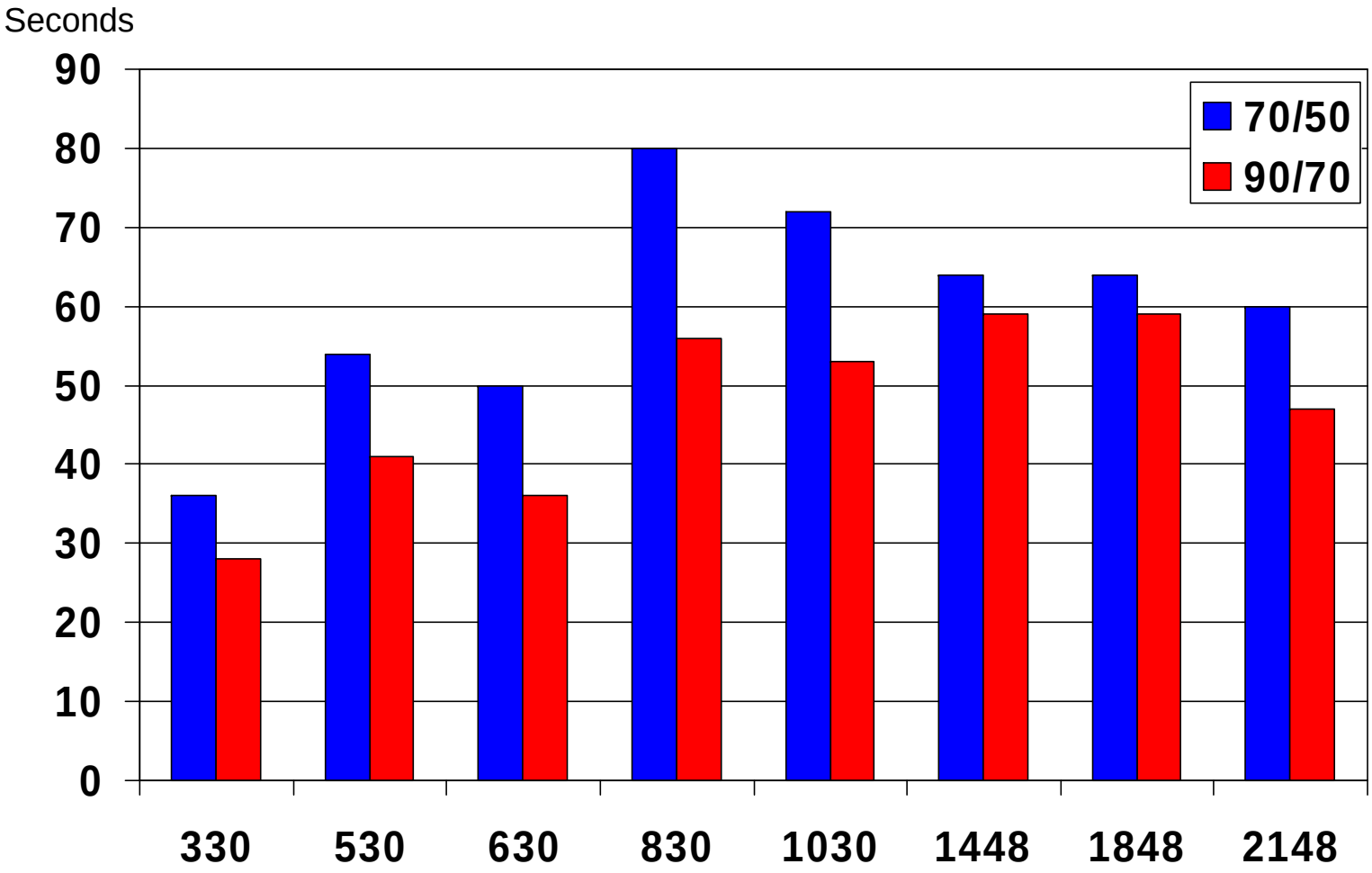
Harvest Cycle Times (seconds)



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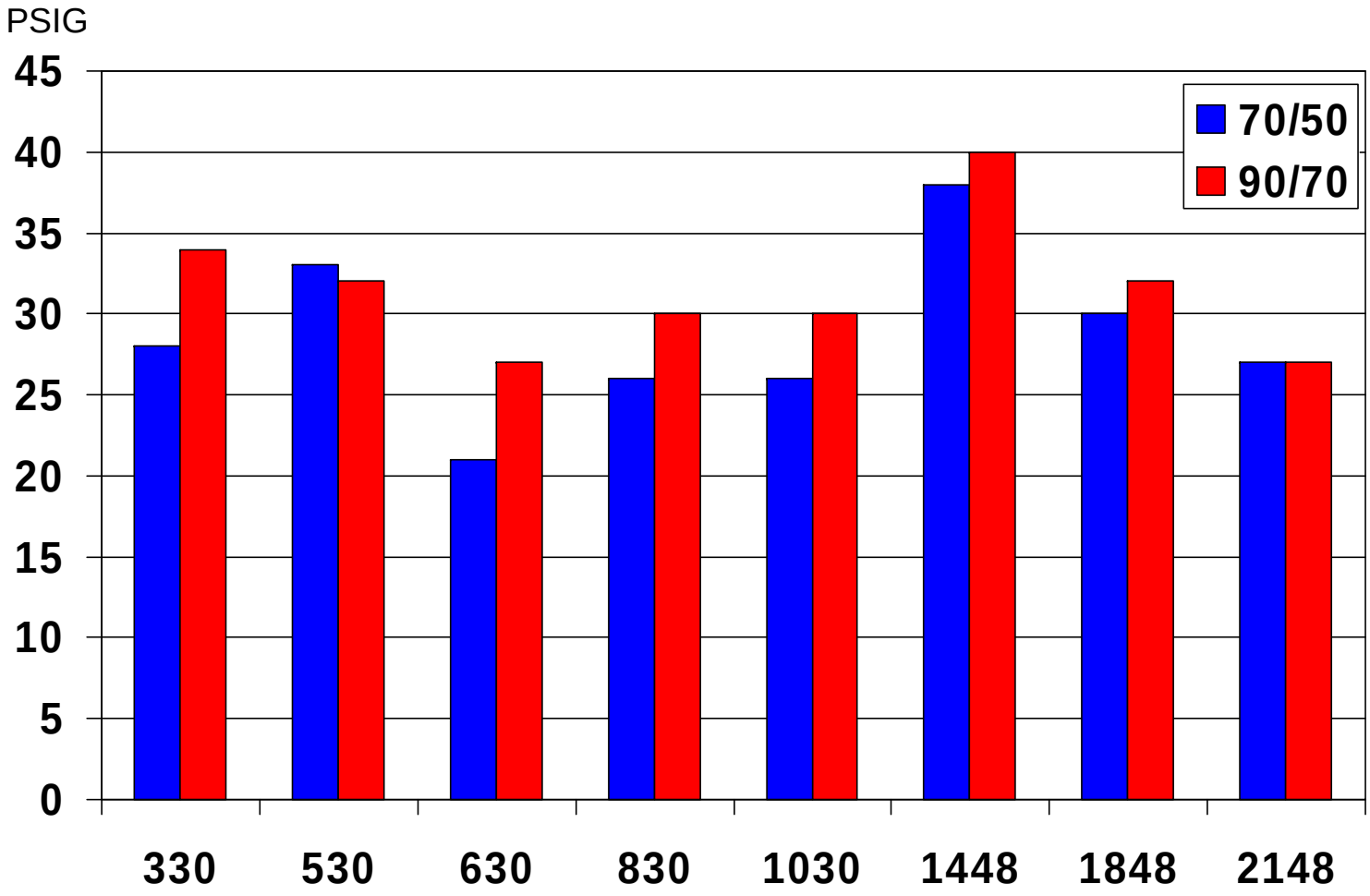
Suction Pressures, End of Freeze



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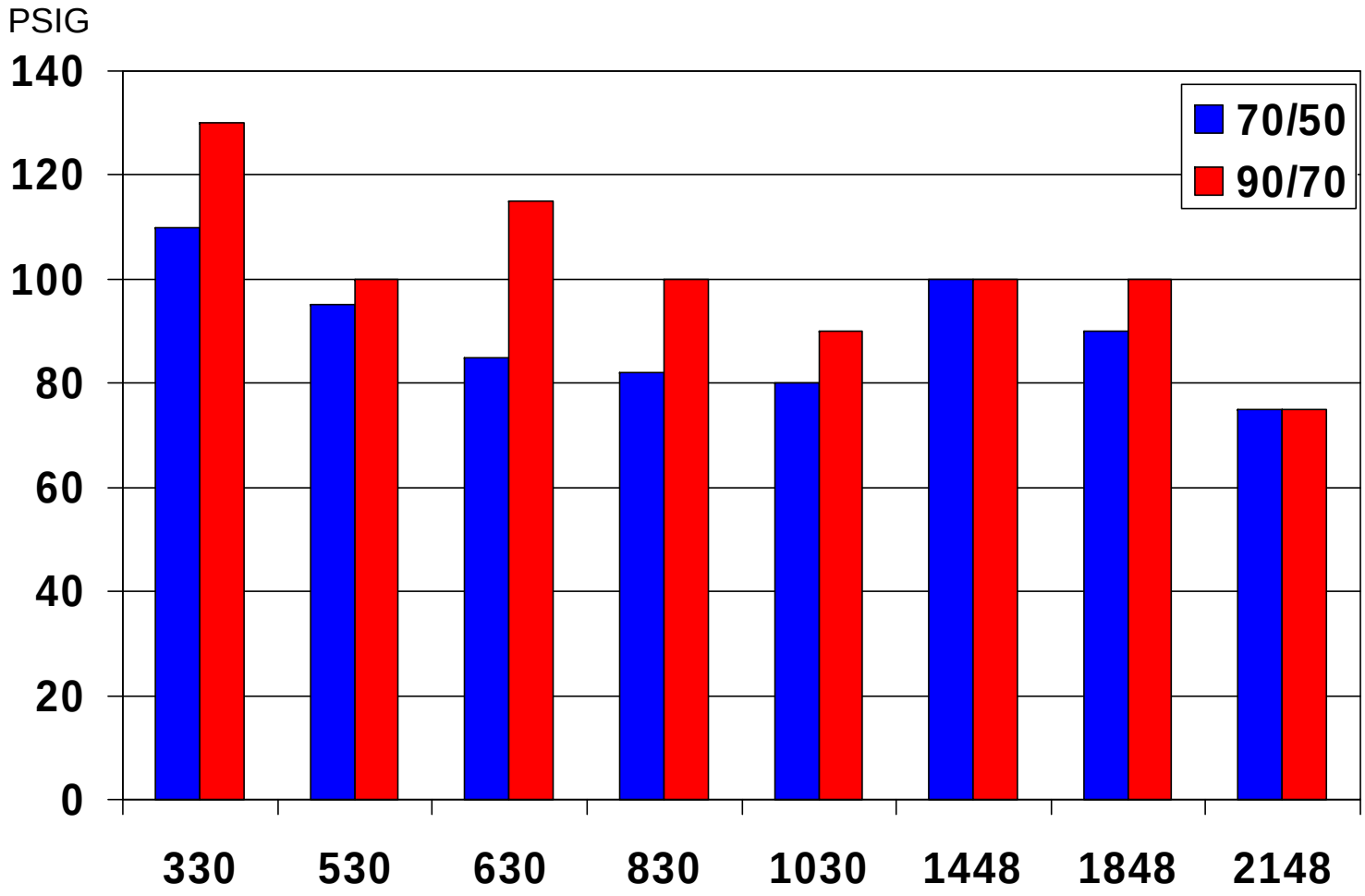
Suction Pressures, Harvest



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Ice Batch Weights

- C0322, C0330
  - 2.4 to 2.6 lb per cycle
- C0522, C0530, C0630
  - 4.5 to 5 lb per cycle
- C0830, C1030
  - 7 to 7.3 lb per cycle
- C1448, C1848, C2148
  - 14 lb per cycle

AutoAlert Light Panel

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AutoAlert Light Panel

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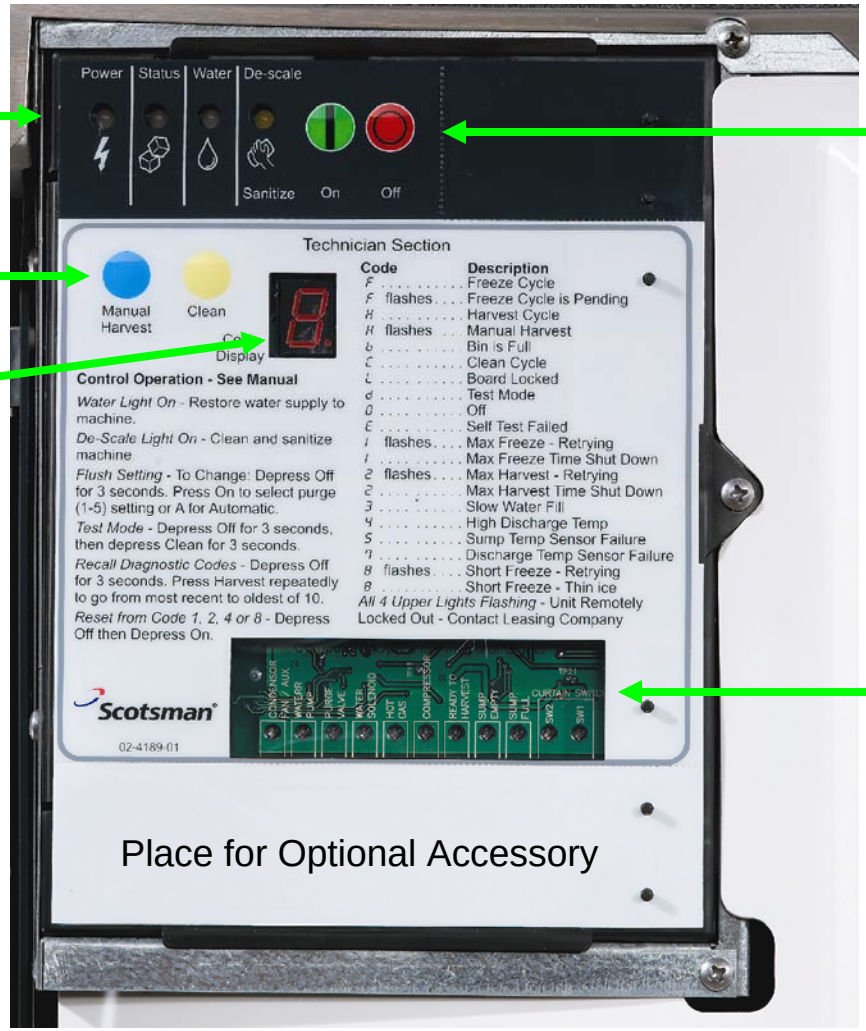
Prodigy Controller

AutoAlert Lights

Manual Harvest and Clean Switches

Code Display


Power
Status
Water
De-scale
Sanitize
On
Off
Technician Section
Manual Harvest
Clean
Control Operation - See Manual
Water Light On - Restore water supply to machine.
De-Scale Light On - Clean and sanitize machine.
Flush Setting - To Change: Depress Off for 3 seconds. Press On to select purge (1-5) setting or A for Automatic.
Test Mode - Depress Off for 3 seconds, then depress Clean for 3 seconds.
Recall Diagnostic Codes - Depress Off for 3 seconds. Press Harvest repeatedly to go from most recent to oldest of 10.
Reset from Code 1, 2, 4 or 8 - Depress Off then Depress On.
Code
Description
F Freeze Cycle
F flashes Freeze Cycle is Pending
H Harvest Cycle
H flashes Manual Harvest
b Bin is Full
C Clean Cycle
L Board Locked
d Test Mode
0 Off
E Self Test Failed
1 flashes Max Freeze - Retrying
1 Max Freeze Time Shut Down
2 flashes Max Harvest - Retrying
2 Max Harvest Time Shut Down
3 Slow Water Fill
4 High Discharge Temp
5 Sump Temp Sensor Failure
7 Discharge Temp Sensor Failure
8 flashes Short Freeze - Retrying
8 Short Freeze - Thin ice
All 4 Upper Lights Flashing - Unit Remotely Locked Out - Contact Leasing Company
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02-4189-01
Place for Optional Accessory

On and Off Switches

Component Indicator Lights

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Code Display

- Letter codes show operational status
- Number codes show shut down causes

Technician Section
Code
Description
F . . . . . Freeze Cycle
F flashes. . . Freeze Cycle is Pending
H . . . . . Harvest Cycle
H flashes. . . Manual Harvest
b . . . . . Bin is Full
C . . . . . Clean Cycle
L . . . . . Board Locked
d . . . . . Test Mode
0 . . . . . Off
E . . . . . Self Test Failed
1 flashes. . . Max Freeze - Retrying
1 . . . . . Max Freeze Time Shut Down
2 flashes. . . Max Harvest - Retrying
2 . . . . . Max Harvest Time Shut Down
3 . . . . . Slow Water Fill
4 . . . . . High Discharge Temp
5 . . . . . Sump Temp Sensor Failure
7 . . . . . Discharge Temp Sensor Failure
8 flashes. . . Short Freeze - Retrying
8 . . . . . Short Freeze - Thin ice
All 4 Upper Lights Flashing - Unit Remotely
Locked Out - Contact Leasing Company

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5 Controller Shut Down Causes

- Exceeds limit on water fill time
  - 5 minutes
- Exceeds limit on maximum freeze time
  - 45 minutes
- Exceeds limit on maximum harvest time
  - 3.5 minutes
- End of freeze triggered too soon
  - Before 6 minutes into the freeze cycle
- Discharge temperature too high
  - Exceeds 250 degrees F.

Controller Reaction

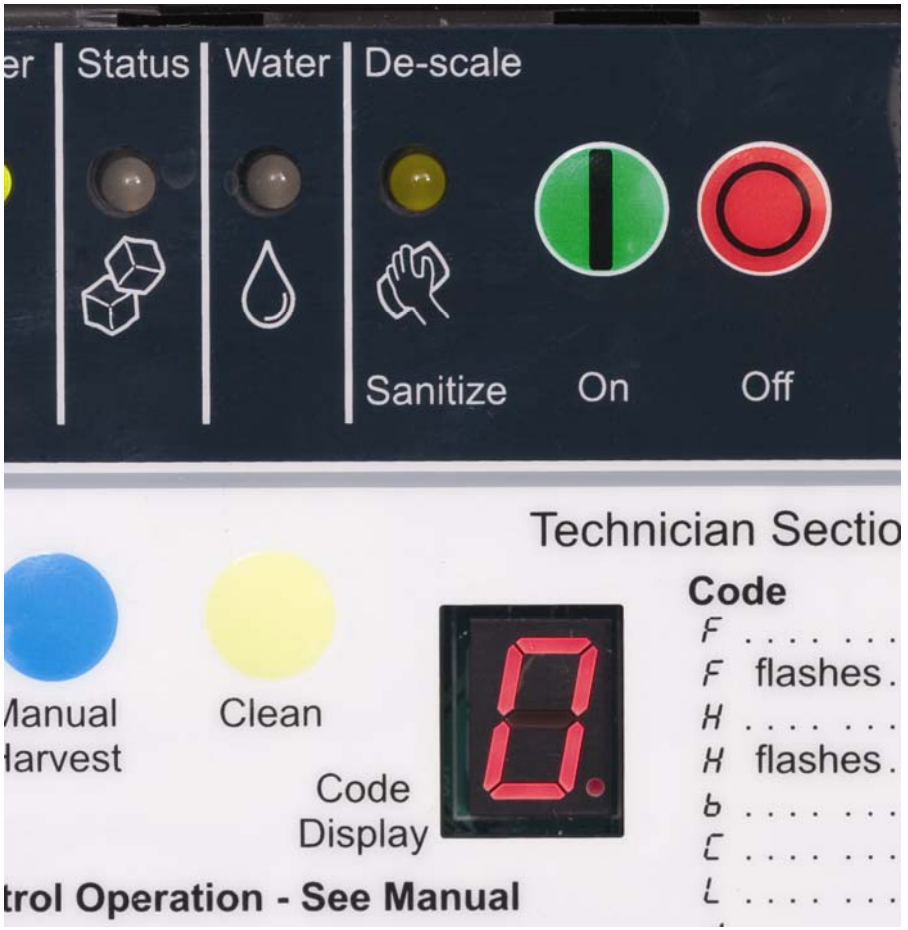
- Exceeds water fill time
  - Shuts down, attempts refill every 20 minutes
- Exceeds maximum freeze time
  - Completes harvest, tries another cycle
- Exceeds maximum harvest time
  - Shuts down, restarts after 50 minutes
- End of freeze triggered too soon
  - Completes timed harvest, tries another cycle.
- Discharge temperature exceeds 250 degrees F.
  - Immediate shut down

Controller Auto Restart

- From diagnostic causes
  - Retries 2 times, if fails again 3rd time, machine must be manually reset
- From water interruption
  - Will continuously restart every 20 minutes
- From power failure
  - Goes thru a timed harvest (3 minutes)

Controller Button Processes

- Reset
  - Push and release Off, push and release On



Control Button Processes

- Recall diagnostic code
  - Push and hold Off to shut the machine down
  - Push and hold Off again until the display code changes
  - Push and release the Harvest button to cycle thru the last 10 diagnostic codes, from latest to oldest

Controller Button Processes

- Clear all diagnostic codes
  - Push and hold Off to shut the machine down
  - Push and hold both the Clean and Harvest buttons for 3 seconds

Power
Status
Water
De-scale
Sanitize
On
Off
Technician Section
Manual Harvest
Clean
Code Display
Control Operation - See Manual
Water Light On - Restore water supply to machine.
De-Scale Light On - Clean and sanitize machine.
Code
Description
F . . . . . Freeze Cycle
F flashes . . . Freeze Cycle is Pending
H . . . . . Harvest Cycle
H flashes . . . Manual Harvest
b . . . . . Bin is Full
C . . . . . Clean Cycle
L . . . . . Board Locked
d . . . . . Test Mode
0 . . . . . Off
E . . . . . Self Test Failed
1 flashes . . . Max Freeze - Retrying
1 . . . . . Max Freeze Time Shut Down

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Controller Button Processes

- View/Change water purge
  - Push and hold Off to shut the machine down
  - Push and hold Off again until the display code changes – code displayed is the current purge setting
  - Press and release the On button to cycle to another setting – 1 to 5 or A for Automatic

WaterSense Automatic Purge

- Controller measures conductivity of the reservoir water
- Adjusts purge water amount based on the water's dissolved solids
  - Display shows an A if set to Automatic (factory default)
- Purge can also be manually set
  - 1 is minimum
  - 5 is maximum

Other Controller Button Processes

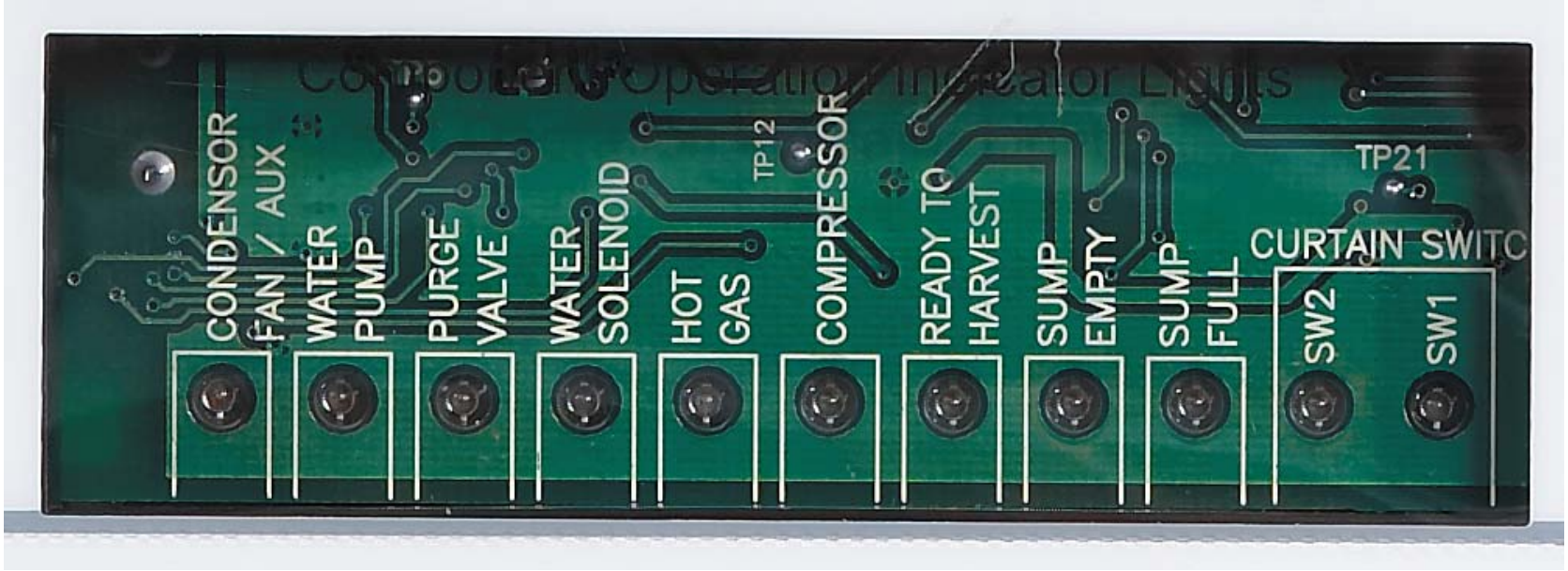
- Empty reservoir
  - Push and hold Off to shut the machine down
  - Push and hold Clean button until the display shows a dash, pump will drain the reservoir for 30 seconds, repeat as needed

Other Controller Button Processes

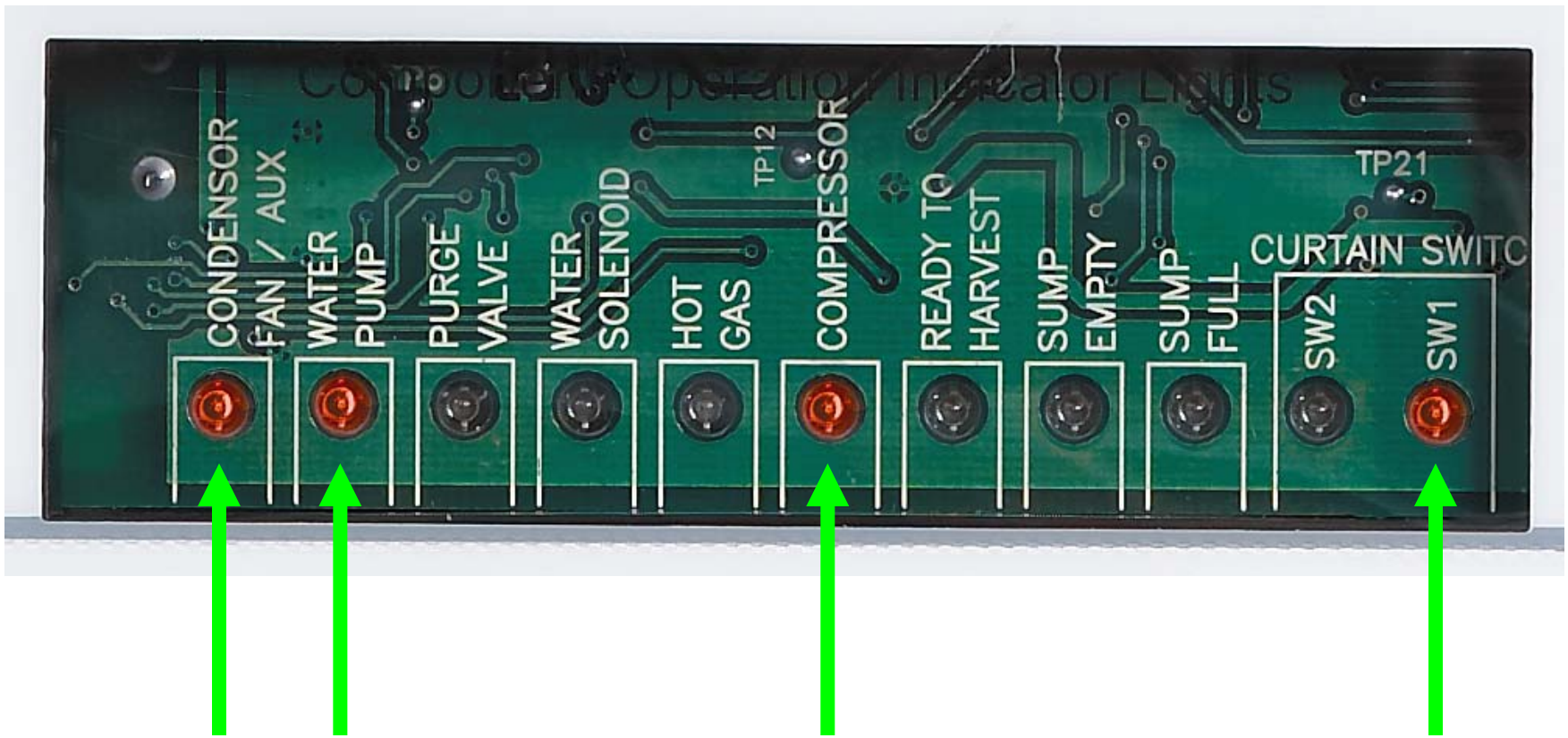
- Adjust time interval for de-scale light
  - Default is 6 months power up time
  - To adjust times:
    - Push and hold Off to shut the machine down
    - Press and hold harvest button for 3 seconds.
    - Display shows current time to clean months
    - Pressing clean button repeatedly will cycle through one of 4 possible settings: 6, 5, 4 or 3 months
    - Rev 5 and higher controllers (11/08 and later) settings are 4 or 6 months, 1 year or disabled (4,6,1 or 0 in code display)
- Test mode will be covered in the Diagnostic Section

Prodigy Diagnosis

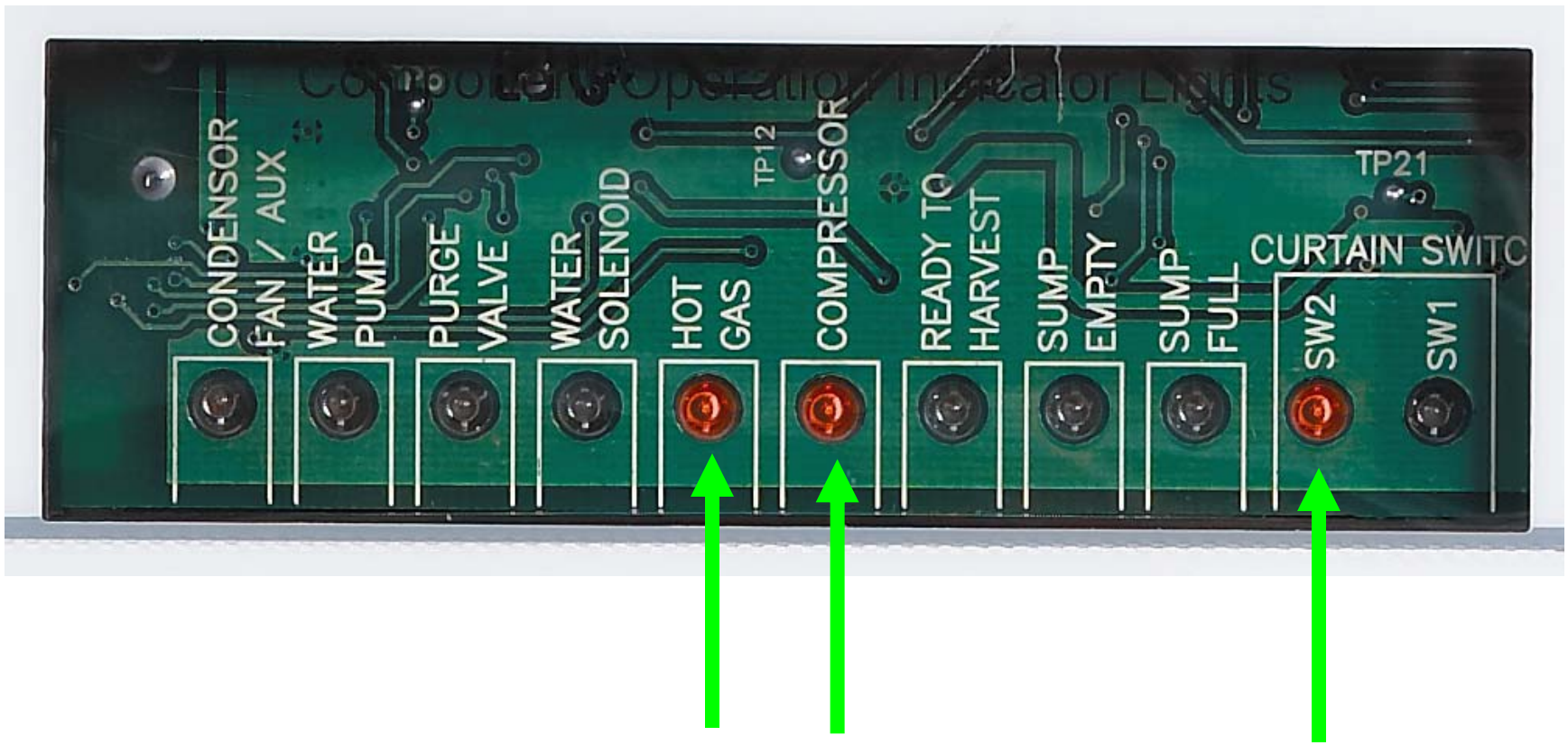
- Use the controller's component indicator lights to check if a component is operating when it should be.



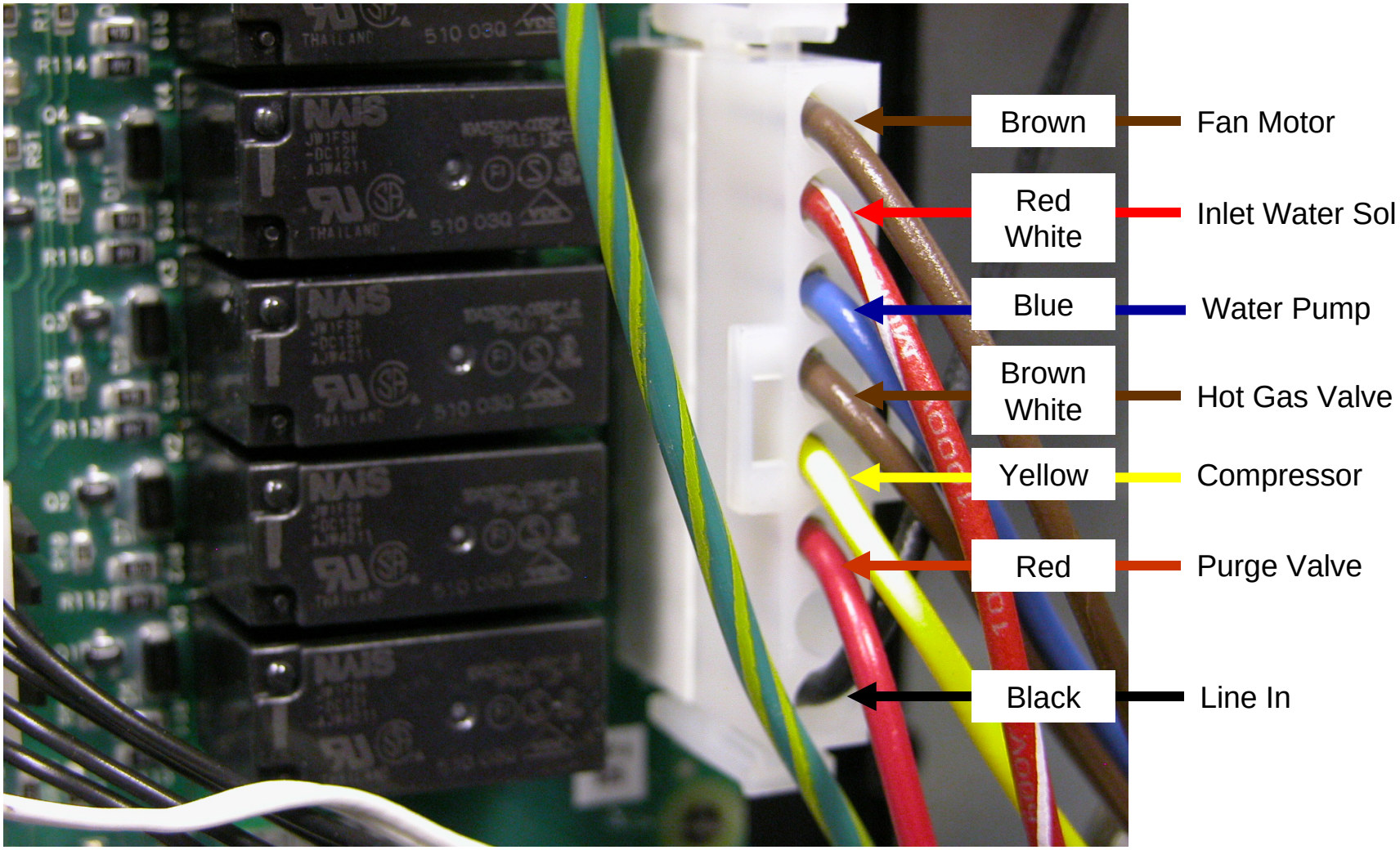
Example: Freeze Cycle



Example: Harvest Cycle



Diagnostic – Line Voltage Outputs



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Diagnostic Process

- Check diagnostic code
  - Use codes as a guide to the root cause
  - Codes listed on the controller overlay
- Remember the Recipe for Ice – a malfunction will be in one of these areas:
  - Water
  - Refrigeration
  - Electrical

Diagnostics

- Max freeze time diagnostic – Code 1
  - Limit is 45 minutes
  - Typical cycle is much shorter
    - 15 to 20 minutes
  - Long freeze cycle causes:
    - Lack of water
    - Lack of refrigeration effect
    - Not sensing ice formation

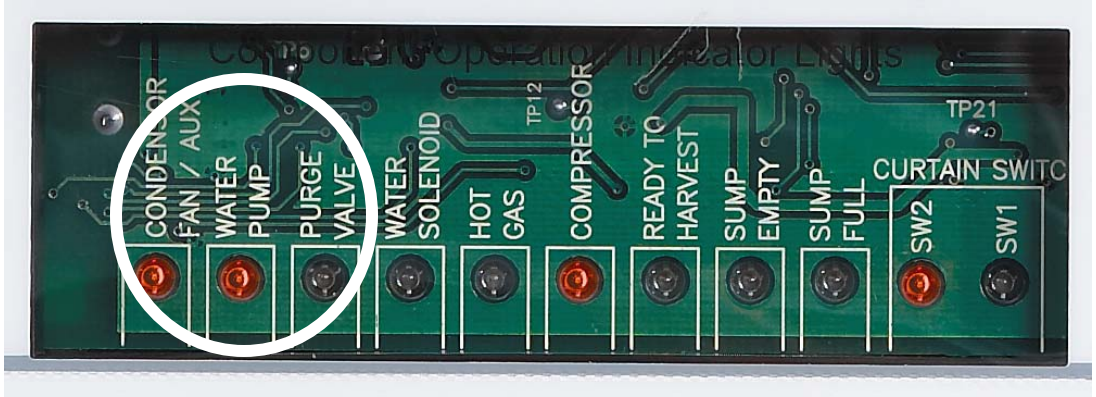
Diagnostics – Code 1

- Lack of water flow potential causes:
  - Water pump failure
  - Leaking pump hose
  - False Sump Full signal from Water Level Sensor
- Lack of refrigeration may be caused by:
  - Dirty air filters
  - Fan motor or fan pressure control failure
  - Water supply to water cooled condenser failure
  - Low charge
  - TXV superheat not correct
  - Compressor contactor failure
  - Compressor overheated or off

Diagnostic – Water Pump

- Check pump for operation during freeze
  - When diagnostic light is ON pump should be operating

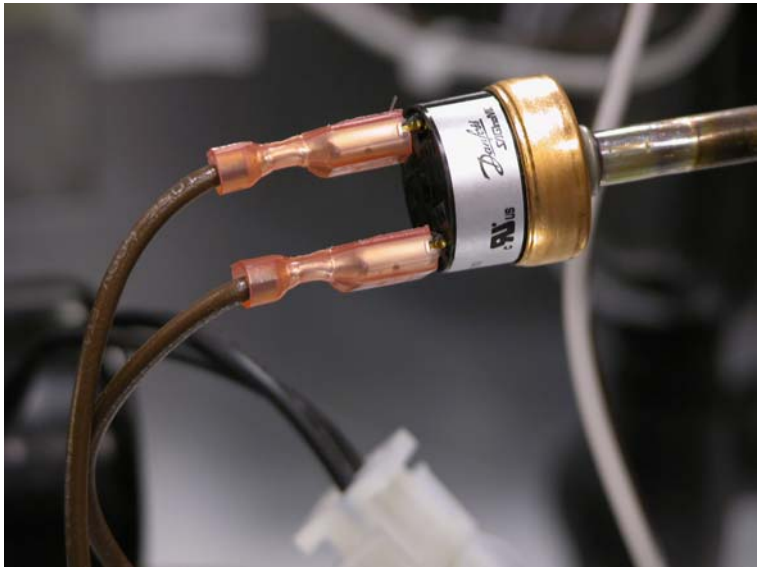
NOTICE:
THIS PUMP MOTOR MUST BE PROTECTED FROM WATER SPLASH WARRANTY VOID IF WATER DAMAGED. BALL BEARING MOTOR
HARTELL
GPP-5SC-1A

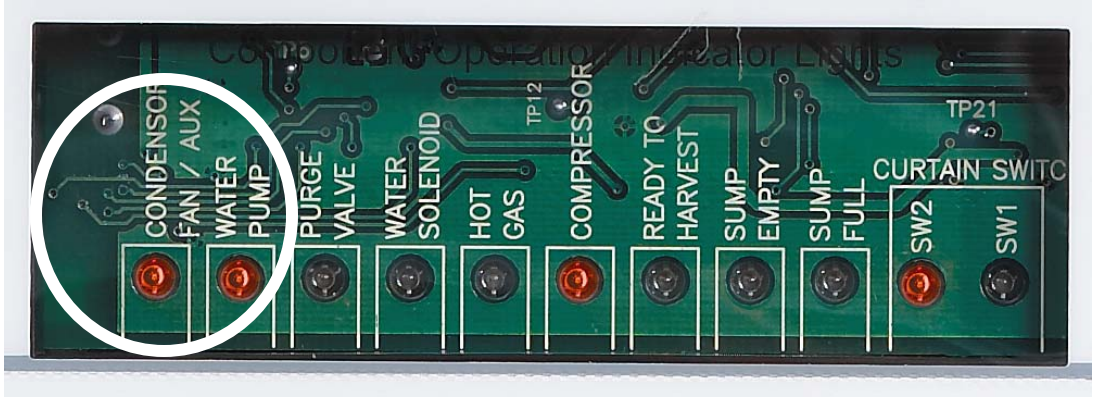


Scotsman

Diagnostic – Fan Motor

- Two controls – controller and fan pressure switch
  - Controller light ON when fan should be ON
  - Pressure switch then controls power to fan motor
    - Jump pressure switch wires together, then power up unit and check fan motor operation

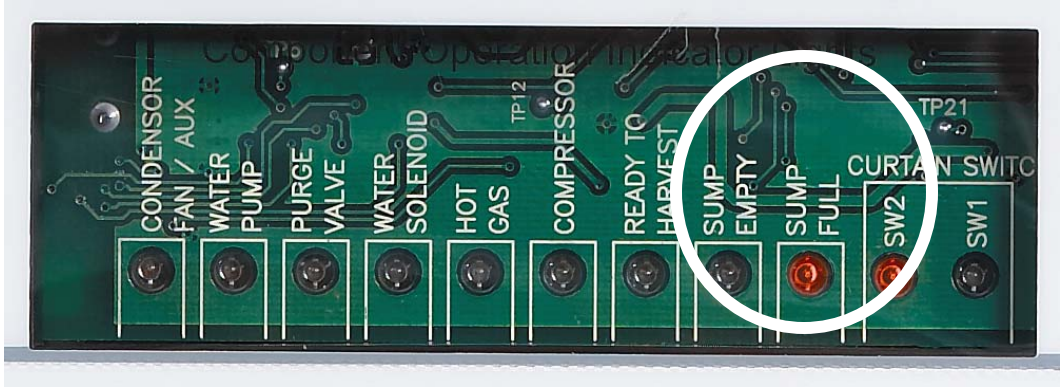




Scotsman

Diagnostic - Sensors

- Water Level Sensor
  - Continuity probe
  - Check by connecting two short probes
  - Sump full light should be On
  - Must be OFF if nothing touches the probes



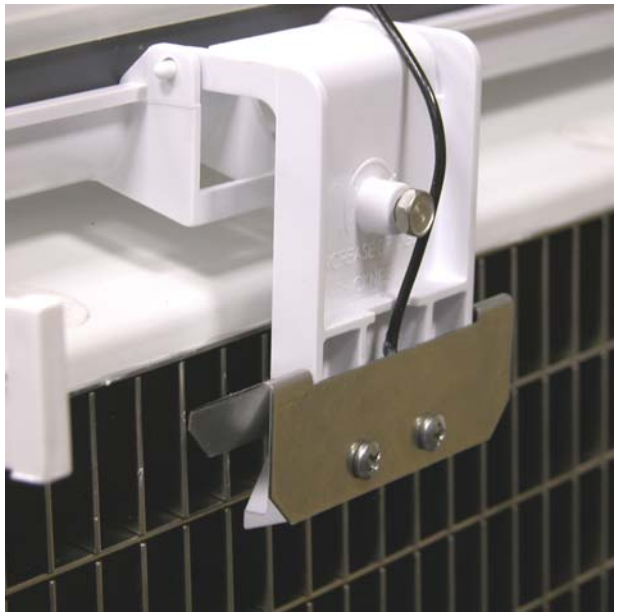
Scotsman

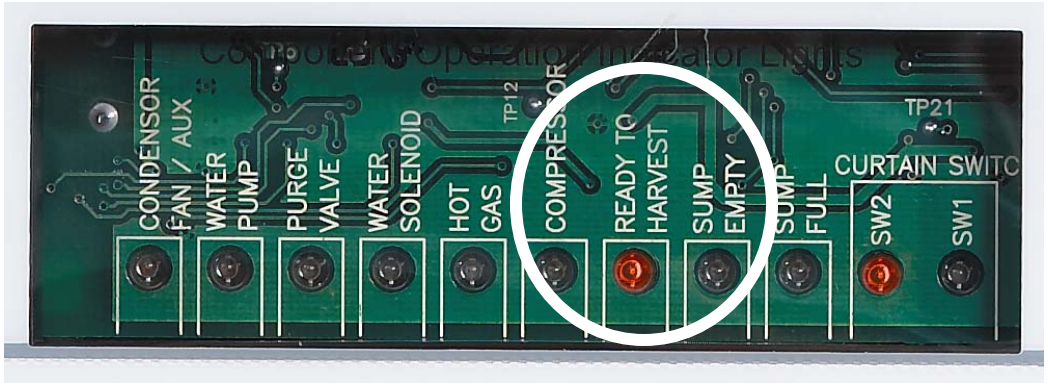
Diagnostics - Code 1

- Control system not sensing correctly
  - Sensor dirty
    - Ice thickness – large bridge
    - Water level – reservoir empty and Sump Full light on
  - Broken wire
  - Out of adjustment
  - Controller not getting signal
    - Check Ready to Harvest Light

Diagnostics - Sensors

- Ice thickness sensor
  - It is a continuity probe
  - Check by grounding metal tip to cabinet and observing Ready To Harvest light





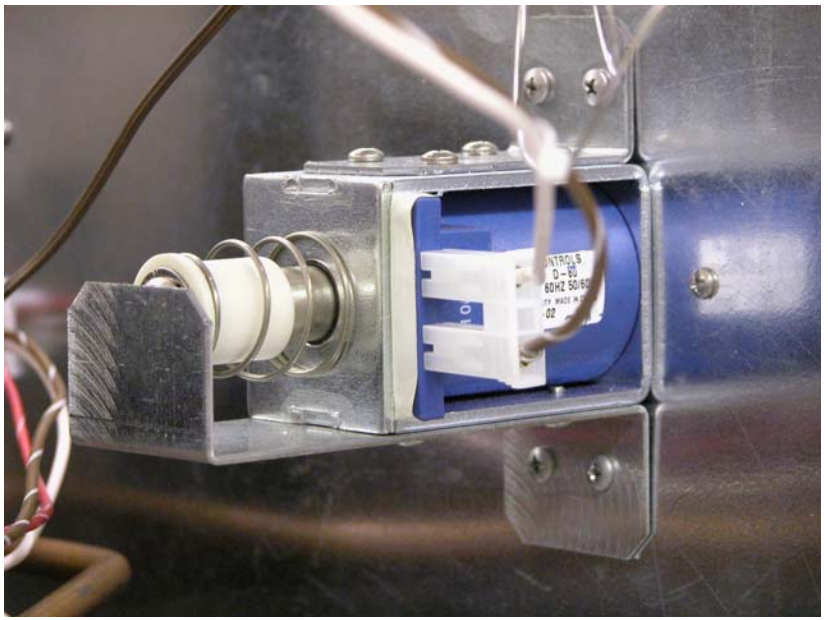
Scotsman

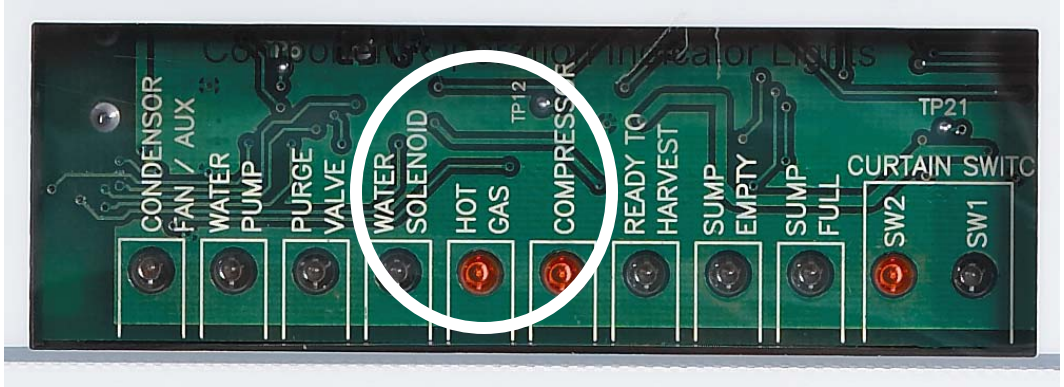
Diagnostics

- Max harvest time – Code 2
  - Limit is 3 ½ minutes
  - Normal time is between one and two minutes
  - Long harvest cycle possibly caused by:
    - Harvest assist solenoid not functioning correctly
      - Not extending or retracting
    - Hot gas valve not opening
    - Curtain switch not sensing when curtain opens
    - Poor or No ice formation
    - Low refrigerant charge

Diagnostic – Harvest Assist Solenoid

- Operates when the Hot Gas valve is energized
  - Check during harvest, if voltage is present, pin should extend when ice releases



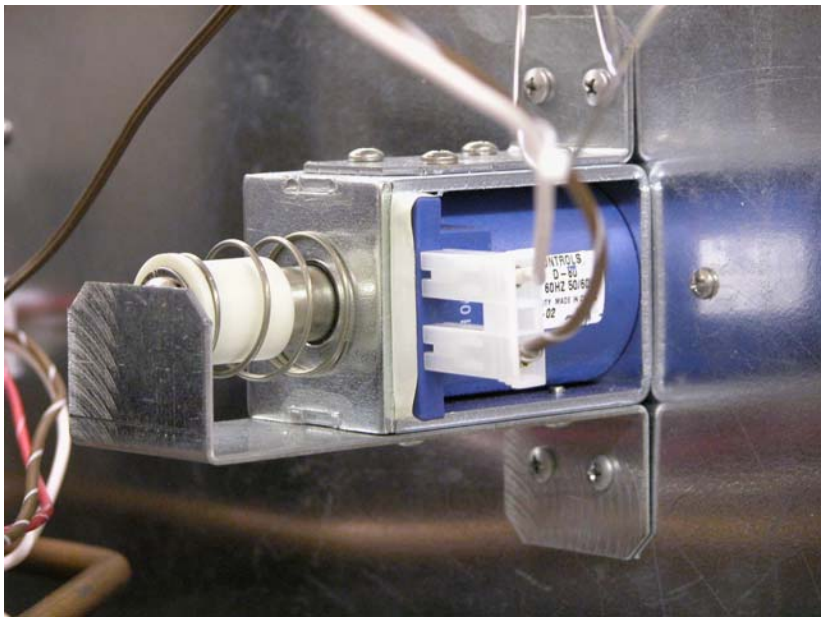


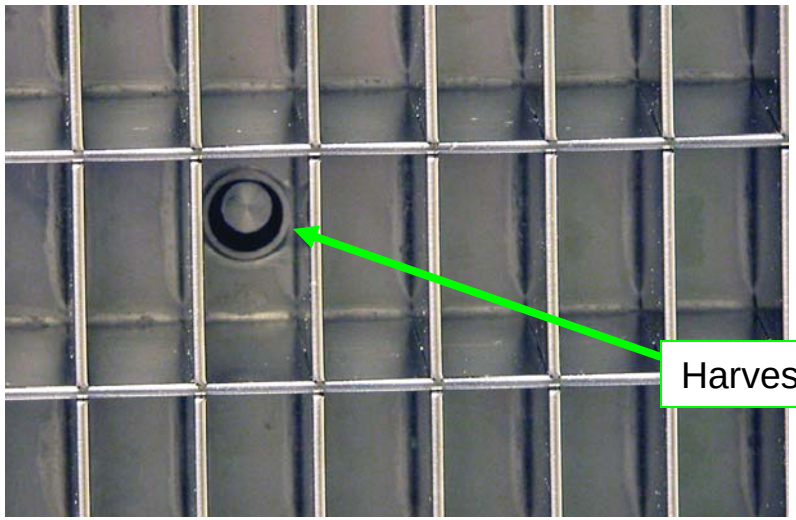
Note: Harvest assist solenoid coil cannot be checked with an ohmmeter. Check voltage instead.

Scotsman

Diagnostic – Harvest Assist Solenoid

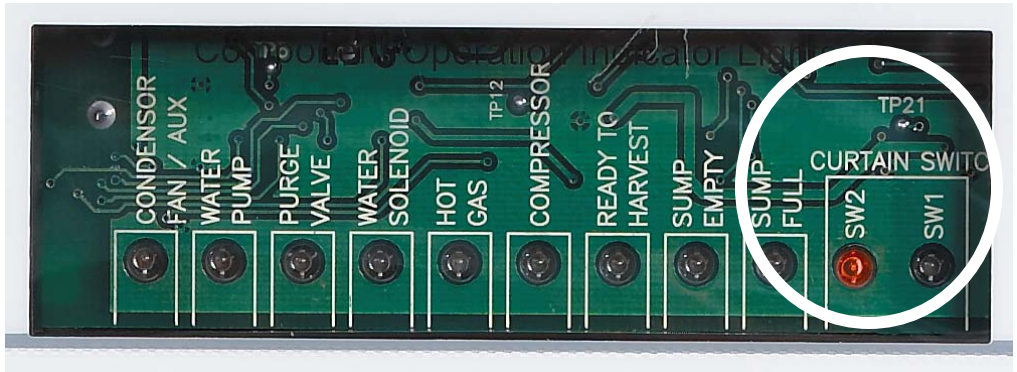
- Spring retracts pin when power is off
  - If pin does not retract, check for binding in evaporator bushing





Diagnostic - Sensors

- Curtain Switch
  - Magnetic reed switch
  - Check with indicator light or ohmmeter
  - When curtain is CLOSED, light is OFF
    - Single plate models have 1 light on all the time



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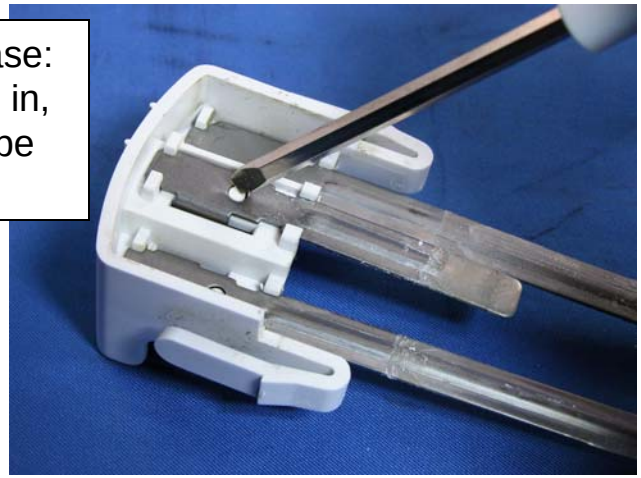
Diagnostic – Hot Gas Valve

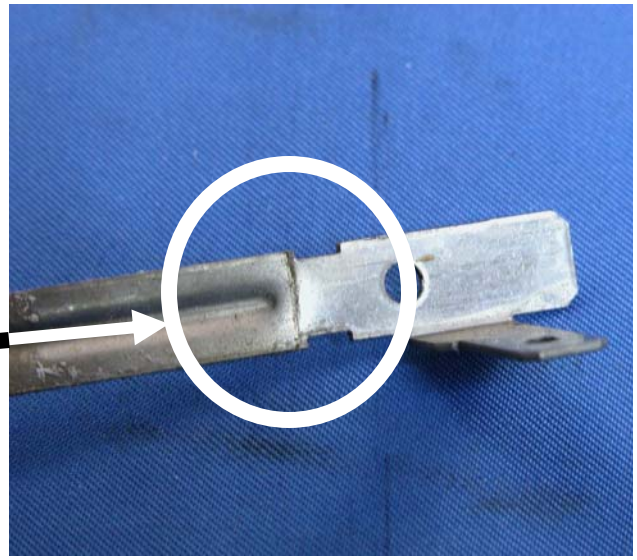
- Opens at start up and during harvest
- Line voltage coil
- Check power to coil when hot gas indicator light is on
- Check resistance of coil when unplugged

Diagnostic – Water Level Sensor

- Sump Full light ON, but no water in reservoir - Code 2 displayed.
- Cause: dirty sensor
  - Solution: clean sensor
    - Release probes from holder
    - Clean probes and holder thoroughly

To Release: Push pin in, pull probe down



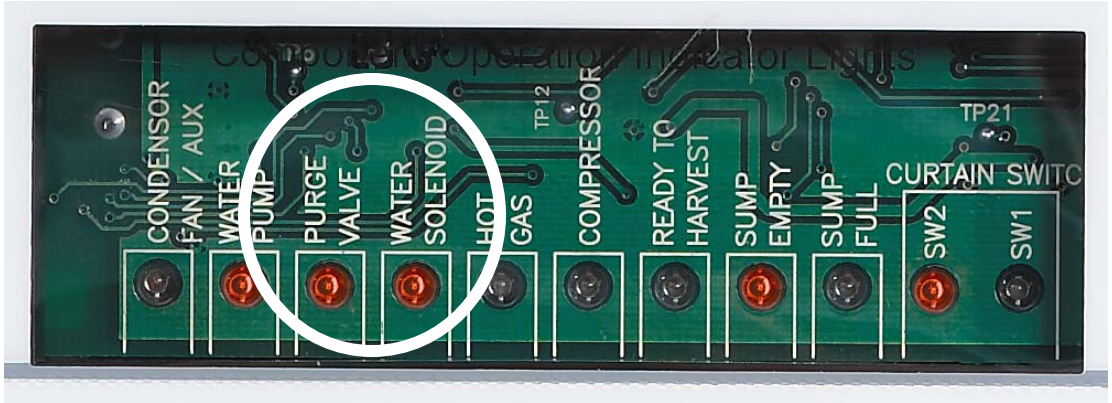


Diagnostics

- Slow or no water fill – Code 3
  - Limit on fill time is 5 minutes
  - Longer fill times possibly caused by:
    - Water supply shut off
    - Water filters plugged up
    - Inlet water solenoid valve failure
    - Controller not opening inlet water solenoid valve
    - Water leak

Diagnostic – Water Valves

- Shut unit off, restart
- Observe indicator lights,
  - Purge valve and water solenoid should be ON and Operating during a restart



Note: Purge valve cannot be checked with an ohmmeter. Check voltage instead.

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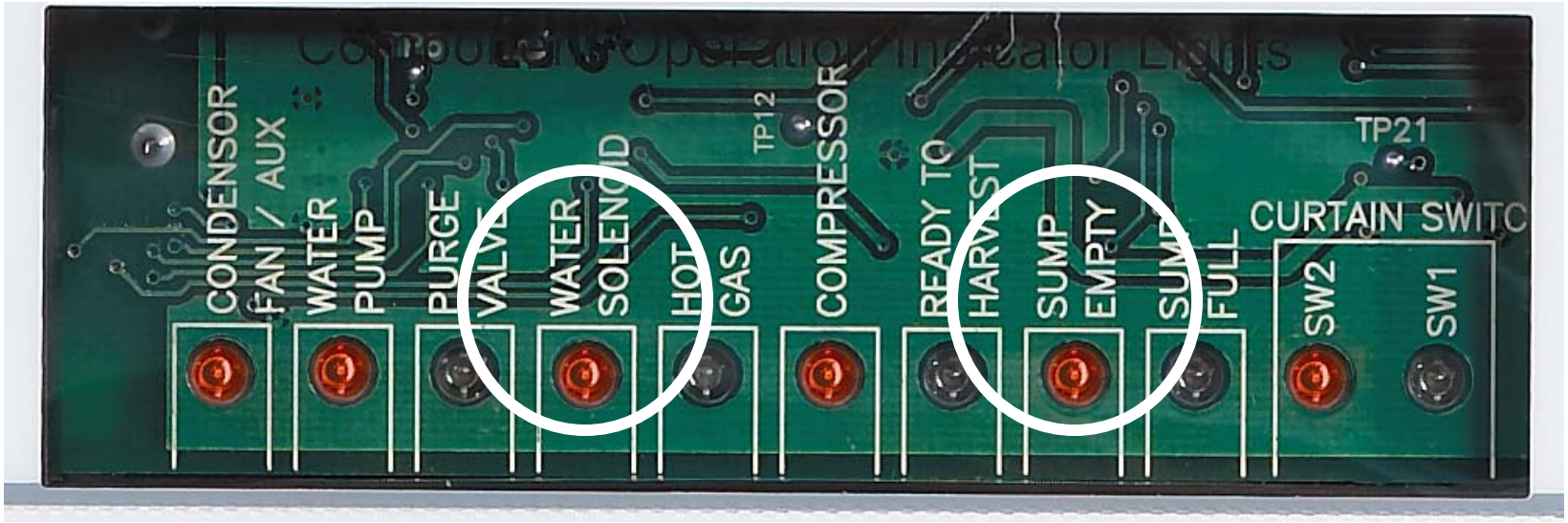
Inlet Water Solenoid Valve

- Quick test: In Freeze, pull Water Level Sensor out of reservoir – Sump Empty light will switch ON and Inlet Water Solenoid Valve should open to fill the reservoir.
  - Note: If Sump Full light is ON water valve will not open



Diagnostics

- High discharge temperature – Code 4
  - Immediate and complete shut off if discharge temperature reaches 250°F.
  - Possible causes of high discharge temperature
    - Fan motor failure
    - Extreme high ambient
    - Hot gas valve leak thru
    - Too much superheat

Diagnostic - Sensors

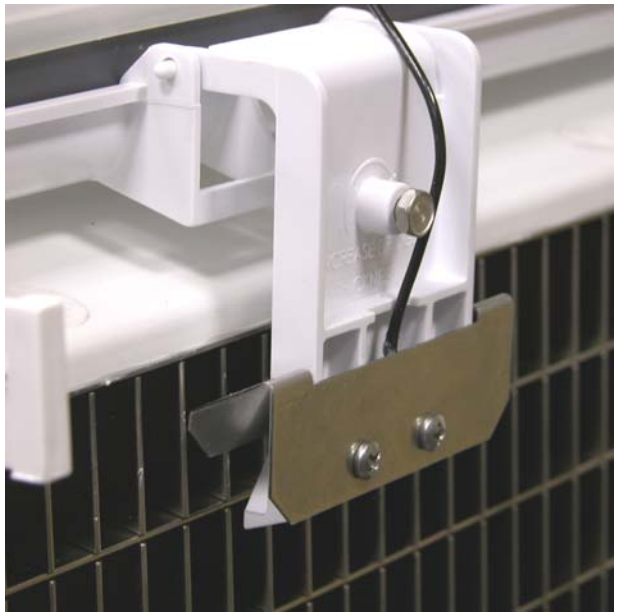
- Display codes **5** or **7** indicate a **sensor** failure
  - Check by measuring resistance of thermistor and comparing to the table at that temperature
    - Table of resistances in manual or handbook, same as for CM^3
- Operation can continue without thermistor use, diagnostic code 5 will be displayed when they are disconnected

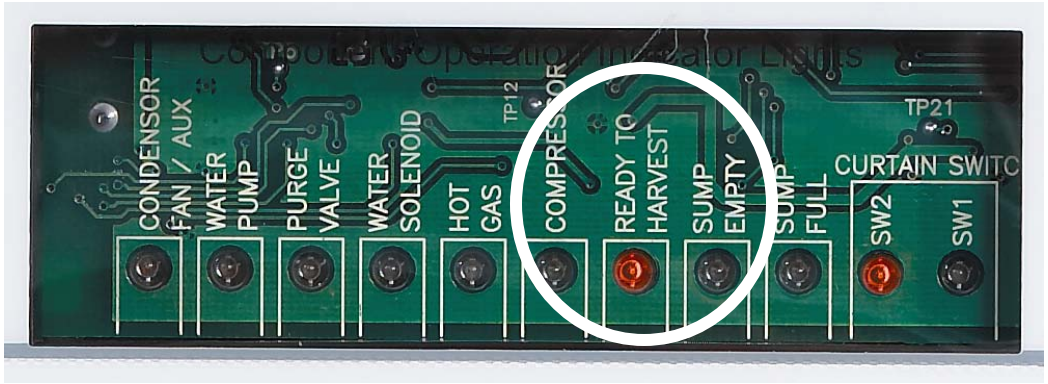
Diagnostics

- Short freeze cycle – Code 8
  - Freeze cycle triggered before 6 minutes
  - Possible causes
    - Improper water flow, water continuously splashes onto ice thickness sensor
      - Scale build up in distributor and / or spillway
    - Improper ice formation and harvest, top part of batch remains on plate after bottom part releases
      - Bridge thickness too thin – not adjusted correctly
      - Ice formation varies over evaporator
        - » Too much superheat

Diagnostics - Sensors

- Ice thickness sensor
  - Short freeze may be caused by irregular water flow or mis-adjusted ice thickness sensor
    - Too thin may trigger harvest before 6 minutes of freeze



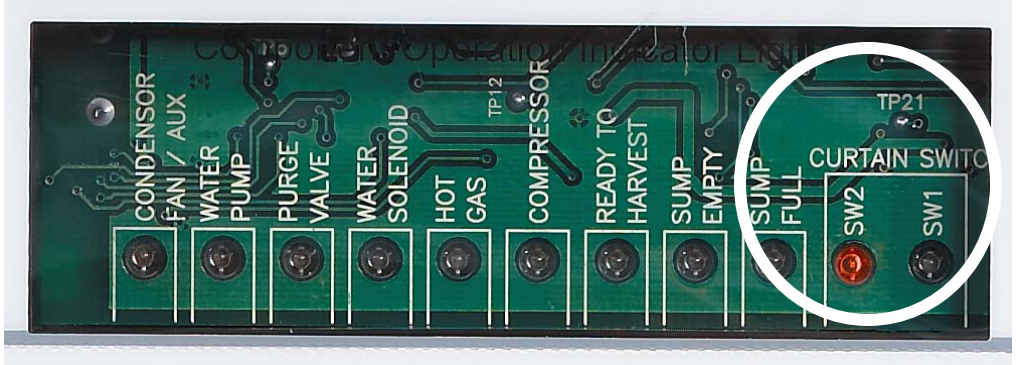


Diagnostics

- No ice complaint
  - Machine is not making ice
  - Bin is not full
  - Status light is on
  - Code b is displayed
  - Possible causes:
    - Curtain is open
    - Curtain switch is open
    - Vari-smart is installed and set too low

Diagnostics – Curtain Switch

- Light is ON when switch is Open
  - Unused switch light is always on
- Move the curtain
  - Check if the light cycles with the curtain's movement or
  - Use ohmmeter on switch leads



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Diagnostic – Test Mode

- Depress and HOLD Off for 3 seconds, release then
- Depress and HOLD Clean for 3 seconds
  - The controller will go through a programmed sequence of switching the components on and off.
    - The Diagnostic lights will switch on and so will the load
      - Fan motor is an exception, the fan pressure control will keep the fan motor off
    - If the light is ON and the load is not, further check of the motor or solenoid coil is required.
    - If the lights all match component operation, there is nothing wrong with either the controller or the components.

Maintenance

- Mineral scale
  - Water sensors and distributor become coated with scale
  - Use Scotsman Clear 1 scale remover to dissolve scale
  - Pay special attention to:
    - Water distributor
    - Ice thickness sensor
    - Water level sensor

Water Distributor

- No fasteners
- Release catches, pull and lift off mounting track
- Pull cover off, rinse out

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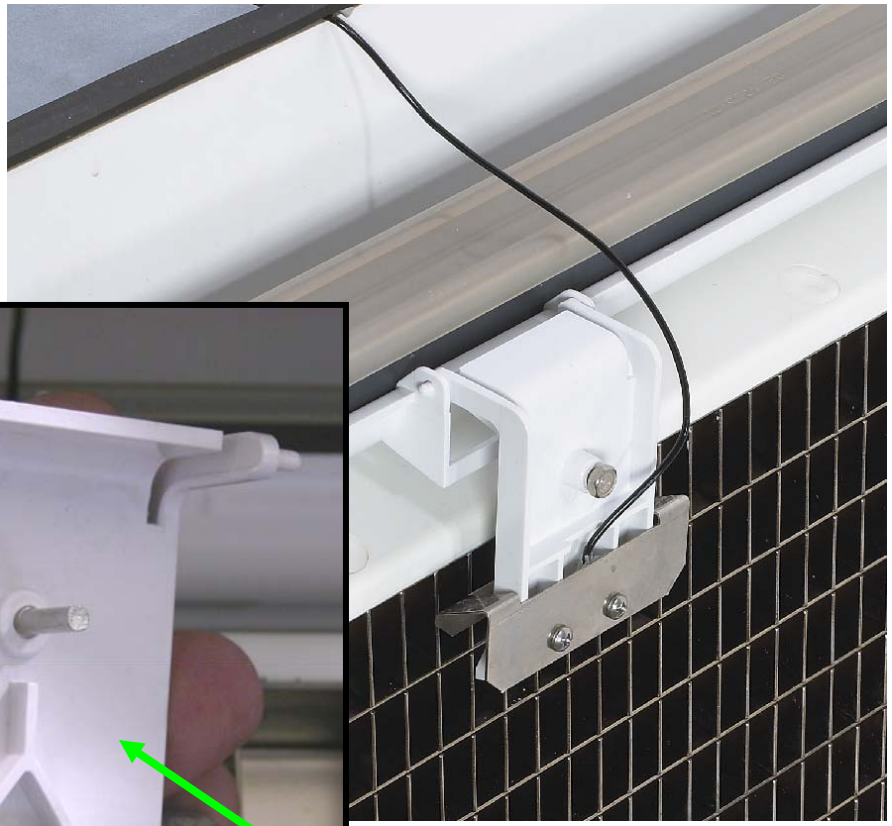
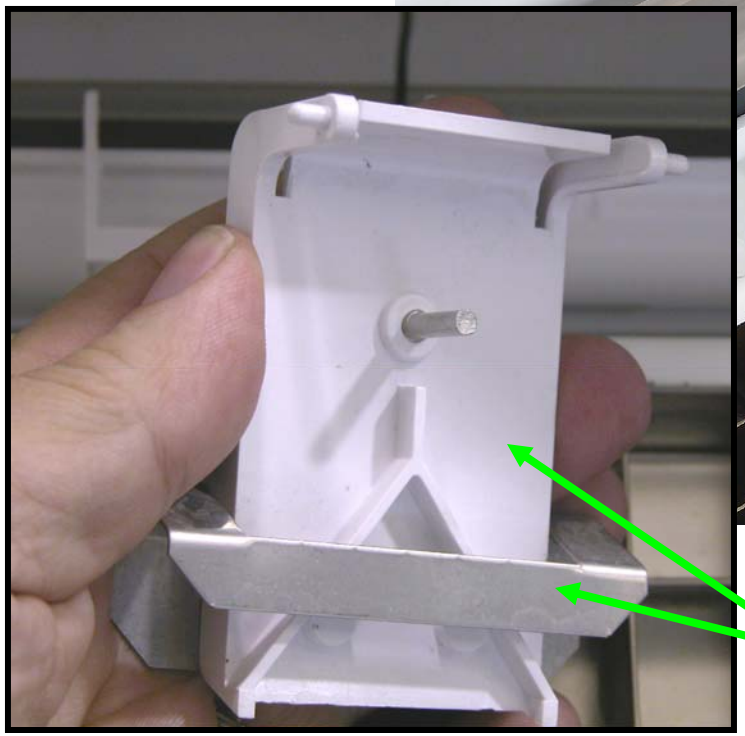
Ice Thickness Sensor

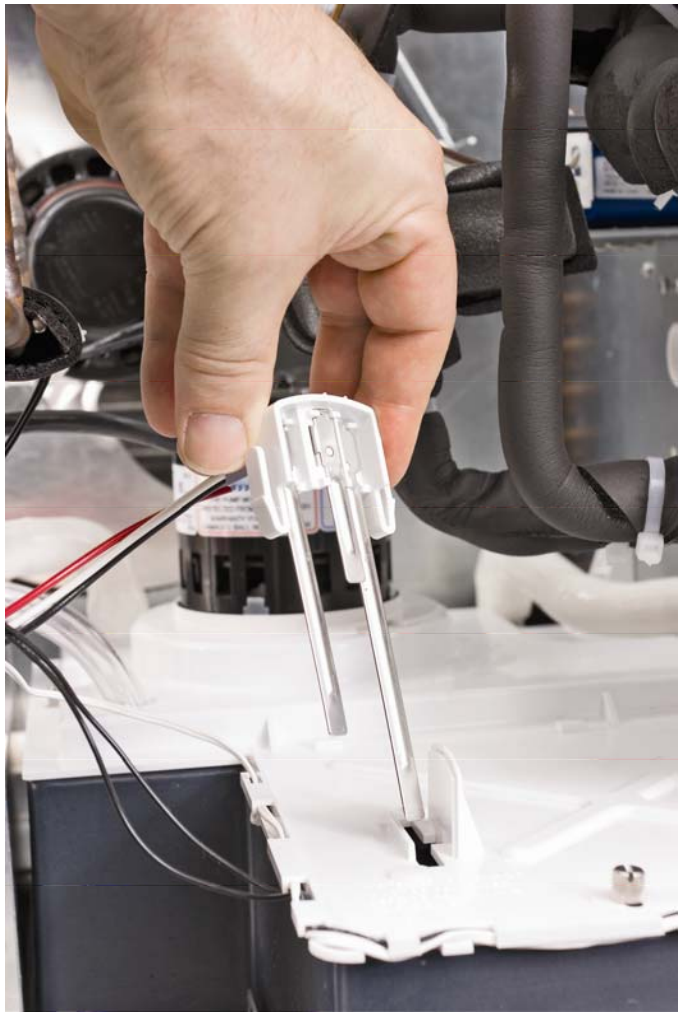
- Wipe inside surface clean with scale remover





Water Level Sensor

- No tools required to remove
  - Release snaps and pull out
- Wipe metal probes clean with scale remover
  - Include base of plastic housing

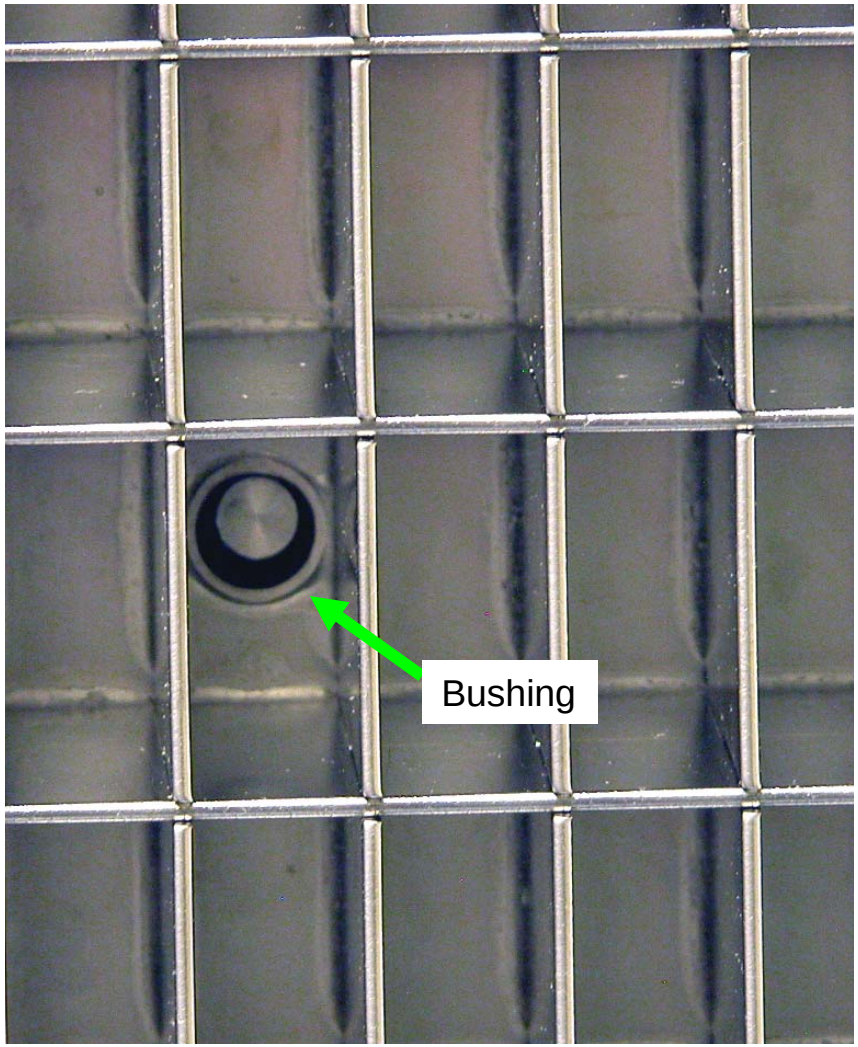


Air Filter

- Slide out, wash off, return.
  - One filter up to 600 lb.
  - Two filters from 800 to 1000 lb.
  - Four filters 1400 lb and higher

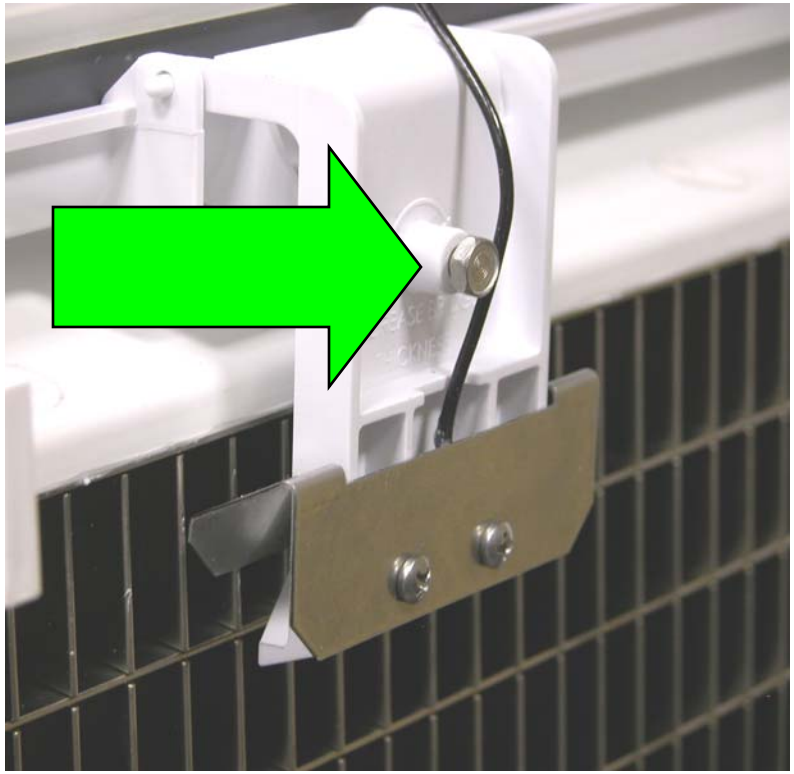
Service Notes: Harvest Assist Solenoid

- Ejector pin must be free to move
  - Loosen harvest assist solenoid mounting screws
  - Align pin in bushing
  - Tighten screws



Service Notes: Ice Thickness Adjustment

- Adjustment screw is very sensitive
  - Rotate only slightly to adjust bridge thickness
    - 1/8 turn is TOO MUCH

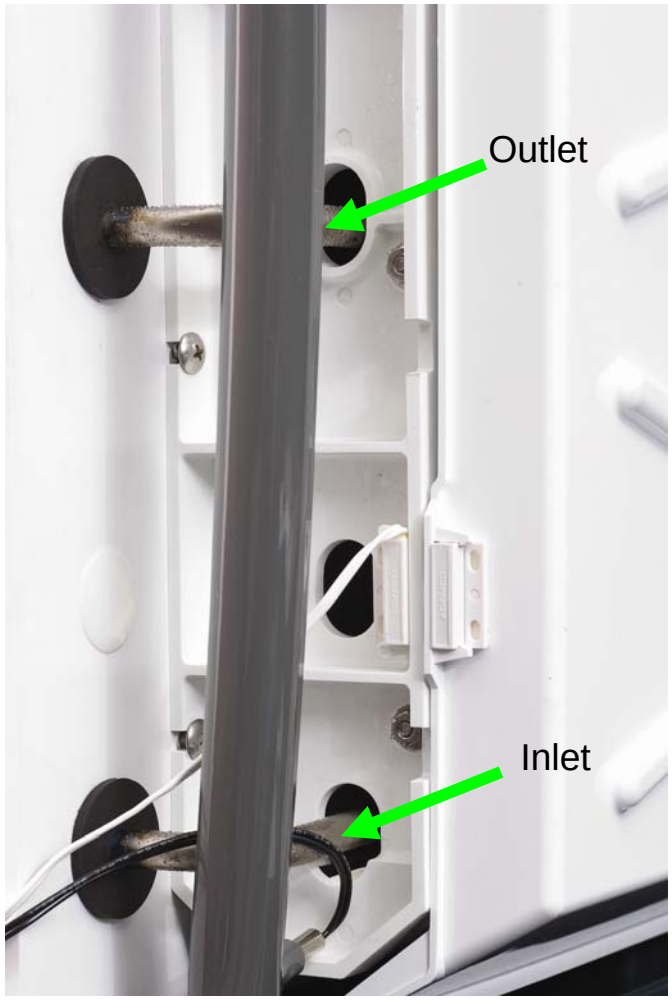


Service Notes: Service Controller

- Discharge static electricity by touching metal cabinet before touching controller
- Selector switch on replacement controller
  - Rotate to correct model per supplied instructions

Service Notes: Refrigerant Charge

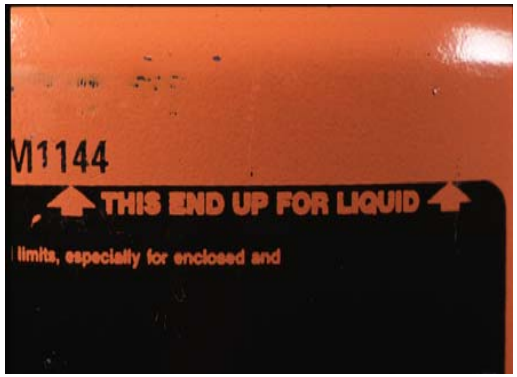
- Ice machines are critically charged
- Refrigerant leak symptoms are progressive – they change as the amount of refrigerant lost increases
  - Thinner ice at evaporator area near tube outlet
  - Longer cycle times, both freeze and harvest



Service Notes – Important Changes

- Controller
  - Auto-selects sensitivity between RO and standard water
  - Push button sequence to shorten, prolong or disable “Clean Me” light
- Curtain
  - Bottom return made longer for better water containment
- Harvest assist solenoid
  - Push rod independent of coil, improves alignment

Service Notes: Refrigeration Service



Liquid Charge

R-404A

Use HFC Leak Detectors

Weigh In Charge

Evacuate to 300 microns

Use Nitrogen Purge

Scotsman®

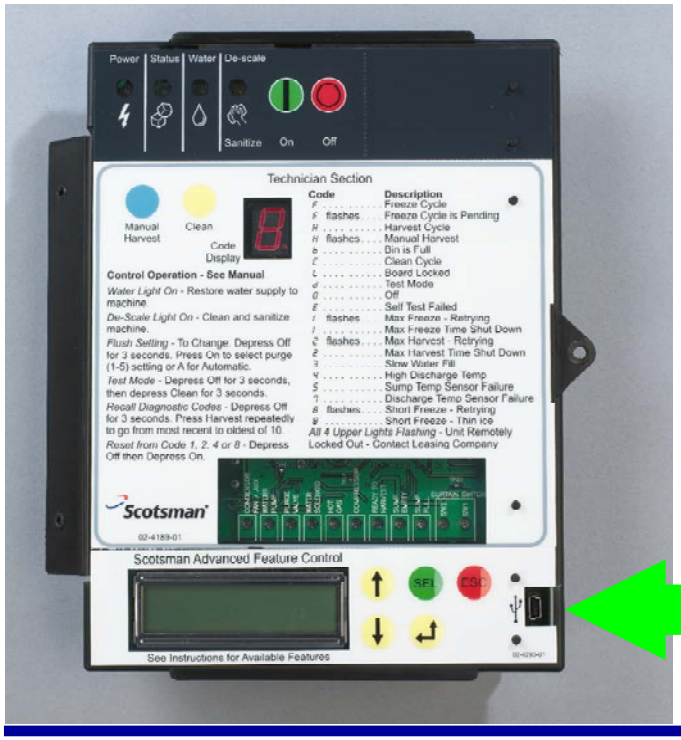
Field Installed Options

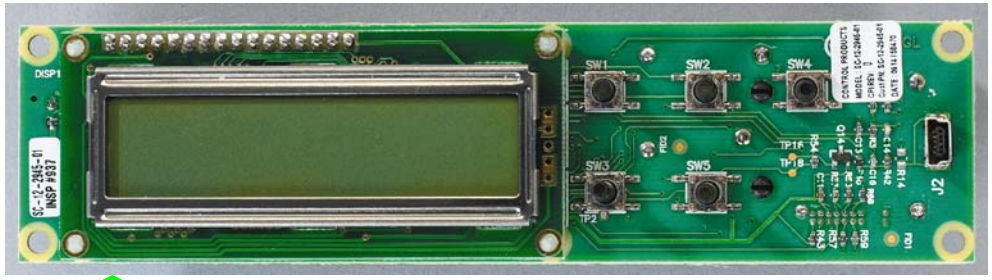
- Vari-Smart – Adjustable ice level control
  - Connects to existing controller
  - Adjustable to maintain a lower level of ice in bin or dispenser

Scotsman

Field Installed Options

- SmartBoard
  - Available as an add-on to the existing controller or
  - As a data logger that can be moved from unit to unit

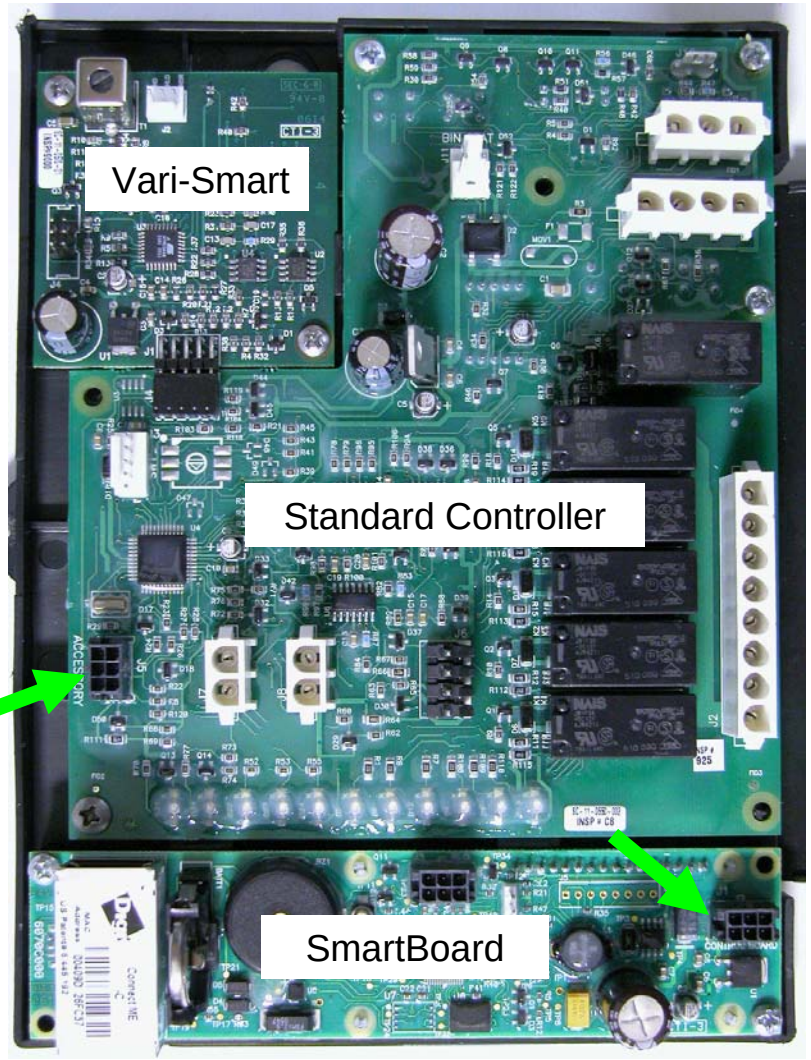




Scotsman

Option Information

- More Vari-Smart and SmartBoard information available in a separate training module



Scotsman

Summary

- Prodigy Cubers
  - Efficient
  - Simple operation
  - Easy maintenance
    - Slide out air filters
    - Slide out water distributor
  - Easy to diagnose
  - Operational Codes on unit
  - Common operation, common parts
  - High Tech Options